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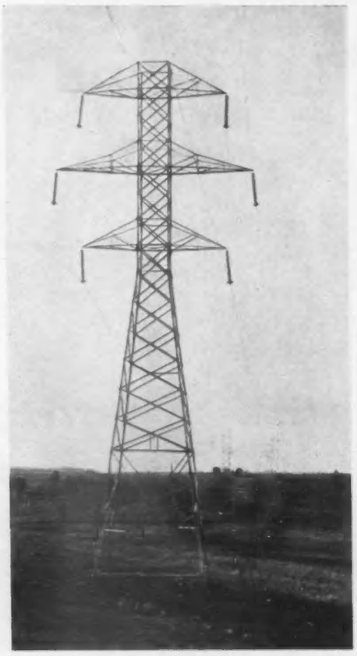
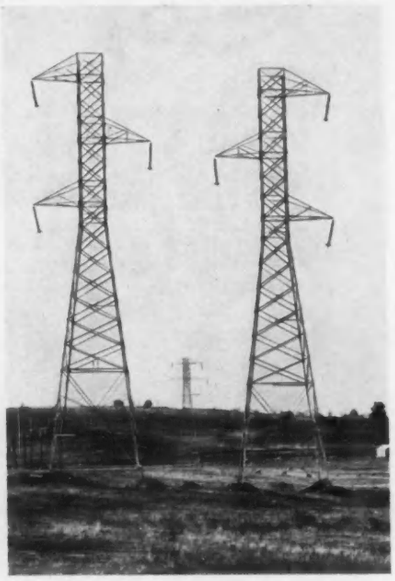


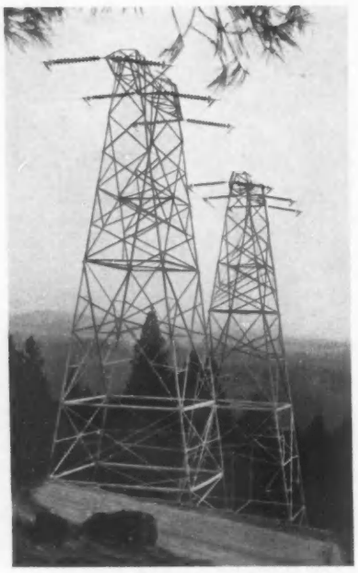


Right—220-kv. Double Circuit, Valley Type Tower with middle cross-arm extended.

Extreme Right — 220-kv. Transposition Towers with double Circuit Valley Type Tower in background.

TOWERS *for the* Mokelumne River Line

The recently completed Mokelumne River Line of the Pacific Gas and Electric Company transmits power from the Mokelumne River hydro-electric plants to Newark substation. This is a 220-kv., double-circuit line. In the mountains and foothills, single-circuit snow-type towers are used; in the lowlands, the towers are of the double-circuit type. All the towers for this 127-mile line, the various types of which are shown in the illustrations, were manufactured by the Pacific Coast Steel Corporation.



220-kv. Single Circuit Snow-Type Dead-End Towers

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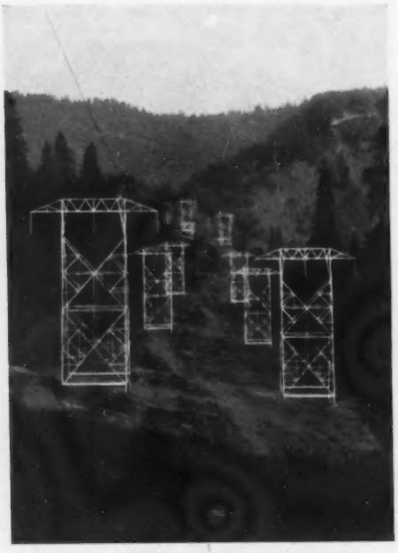

220-kv. Single Circuit Snow-Type Towers.

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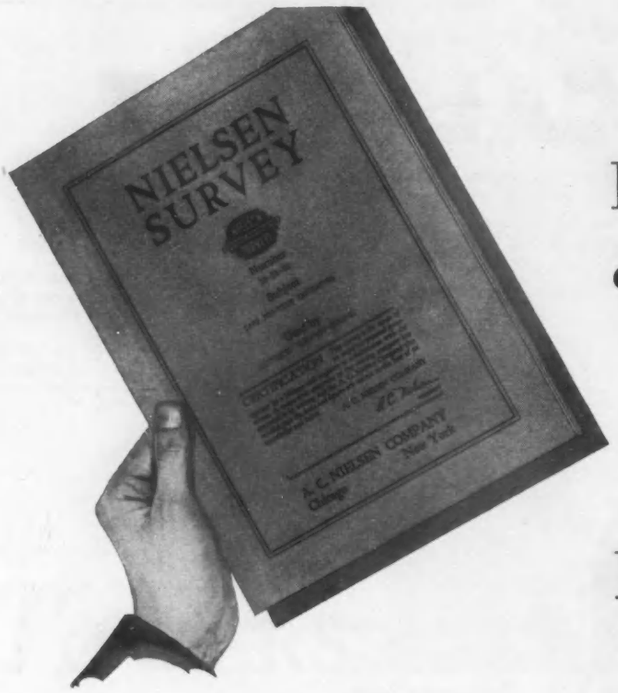

How Panhandle Power & Light Company *Reduced* INSULATOR REPLACEMENTS

DURING 1930 the Panhandle Power & Light Co., Borger, Texas, was installing conventional two-piece pin-type insulators on some 243 miles of 33-kv. line. An average of five insulators per mile was broken in the handling.

The ample sections of Lapp Fog Type Insulators No. 5842 led the company to try these on two short lines. Not a single Lapp Fog Type Insulator was broken before or during installation on these 22 miles.

During nine months of service, 60 conventional two-piece units required replacement on 221 miles—.36 units per mile per year. On the 22 miles of Lapp-insulated line one replacement was made, due, it is thought, to a rifle shot—.06 units per mile per year.

The 45 miles of new construction in 1931 carried Lapp Fog Type Insulators only. They show an annual economy of $3.41 per mile, without considering labor and overhead charges for replacements.

Carbon-black plants near a substation coated insulators with carbon, causing flashovers. Lapp Fog Type units were substituted and there have been no flashovers since.

The entire report, by Nielsen Engineers, is free for the asking.

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G. C. TENNEY, *Editor*

NEWSPAPERDOM'S kings of public opinion viewed and approved the Mokelumne development of Pacific Gas and Electric Co., and one, a former railroad commissioner, compared public and private ownership, then dedicated the works and turned on the water wheel in the public interest, charging private individuals with responsibility of operation until the public proved itself capable of assuming the job.

▼

MEANWHILE, brought to a successful coordinated culmination, were six separate projects of this "five year plan" for power development and distribution. Besides the dam and two hydro plants, other units included a steam station, transmission line, substation and tie line.

▼

SUPERINTENDENTS may come and mayors may go, or vice versa, but Seattle's political wrangle over its lighting plant goes on forever, oblivious to the only sound reasons for any changes whatsoever—cold, economic facts and engineering considerations.

▼

ONE warm night on the desert's edge, coatless executives of The Southern Sierras Power Co. turned power into the line which that company had just finished to supply Hoover dam construction with energy for the work. The same line will return power to southern California when the plant is finished.

▼

IF Greek were to meet Greek Theaters such as the modern Los Angeles' example, the classic tug-of-war would give way to amazement at the enhancement of the original by modern lighting.

The Month

CALIFORNIA paid the first of its bills for its sportsman's fish by reimbursing a chemical project for funds expended in good faith on contemplated Klamath power development. Its future payments in perpetuity will not be so obvious, lost taxes on revenues which will never be made from wealth and resources never to be developed.

▼

RE-INSPECTION, like prohibition, and other laws have been looked upon as all sufficient panaceas. As with any law, tactful administration counts for more than bludgeon authority.

▼

CAN radio sell merchandise? Some tests of the medium as salesman open up the field for further speculation and trial.

▼

HARVEST time is the time of fairs and exhibitions. Electricity which now contributes to prize harvest bounty, offers its wares attractively at such festival occasions.

▼

TEMPORARY injunction was granted Utah Power & Light on Idaho's new kilowatt-hour tax. While the courts test this case legislators in several other states watch with hopeful eye, anxious to find new ways to raise tax moneys for constantly growing public expenditures.

Editorial

Needed—Research Laboratory to Study Electrical Utilization

ELECTRICAL WEST proposes that the electric light and power industry of the Pacific Coast establish a research laboratory devoted to the investigation and study of the practicable, economical and feasible future uses of electricity by industry, agriculture, commerce and the home. Great as has been the application of electric power to almost every phase of daily life, the future possibilities, when set down, are such as to stagger the imagination. It is for the future that such a laboratory is needed.

There is ample justification for a research laboratory that will devote its entire attention to utilization of electricity. Two electrical laboratories here on the Pacific Coast, one at Stanford University and the other at the California Institute of Technology, have made noteworthy contributions to the science of generation, transmission and distribution of electricity. The effort, time and money spent in establishing and maintaining them have been amply repaid.

Such research on the application of electricity as has been done in the past has been performed by the manufacturers who sought to develop apparatus or appliances for sale, or by a particular industry which had a specific problem in the application of electricity to its peculiar needs. The power companies, themselves, however, are the ones most vitally concerned in the future development of the electrical market, both for continued growth and for the ultimate satisfaction of their service obligation to the public which does not cease until a customer is making every practical and economical use of electricity warranted by his demands for service.

A step in this direction has been made in the case of the various Committees on the Relation of Electricity to Agriculture. Funds supplied by the light and power companies have been expended for research under the direction of these committees with results that have exceeded all expectations, both in new electrical applications developed and in new load made available.

The American Telephone and Telegraph Co. affords a splendid example of what may be expected from research. Most of the rapid strides which have been made in the field of telephone communication are directly traceable to research studies conducted in the Bell Laboratories. In 1929 the amount expended for such research totaled $19,000,000 and in 1930 the laboratories had a budget of $24,000,000. Byproducts of this research, which include development of talking movies, electrical transcription and permalloy, alone have amply justified these expenditures.

The electrical industry need not expect to start initially with the elaborate organization and impressive appropriations of the telephone company. However, an endowment of a million dollars is not beyond reason. The cooperation of some of the Western educational institutions might be enlisted. There are innumerable methods of procedure which might be followed.

The project of establishing such a laboratory is one to which the leaders of the industry should give thought and study. The electrical industry has a reputation for planning for the future. Its development and progress are results of this planning. Why not take steps now to assure a continuation of this development and progress?

A "Five Year Plan" That Really Worked

FROM that military commune, Russia, there come many reports of its "five year plan" for industrial development. American economists, racking their brains for panaceas for the world depression, cures that will prove lasting rather than merely ameliorative, have described Russia's experiment as a challenge to American business to plan likewise. The challenge is an economic one, not political, said Chester Rowell at the recent P.C.E.A. convention, and hence demands a plan from American business for its own logical future development. In the electric light and power industry, according to that speaker, American business can find its example of how such long-time planning of production and distribution may be accomplished.

Certainly if ever a concrete example, not an experiment but an actuality, of long-time planning were needed, the Pacific Gas and Electric Co.'s coordinated Mokelumne and Station "A" development, described at length in this number, is almost perfect. As a five year plan it is a remarkable culmination of six major projects, each one a large scale engineering feat in itself, into one complete whole.

A massive granite dam, two hydro-electric plants, a long and intricate flume line, a 220-kv. transmission line, an extensive substation load center, a high-

pressure steam generating plant, and a tie line to another system—each was planned, started and finished precisely as it was required to fit into the finished work.

Performed well within the original cost estimates—a point the public ownership enthusiasts would do well to appreciate—finished within the month originally planned five years previously, gaged to the growth in power demand so accurately that its plants will save the system from the shortage in power which this dry season ordinarily might presage, the project is so excellent an example of engineering foresight, of efficient organization, of planned performance that it leaves nothing to be desired. That it happens to be our own country rather than in Russia, and has been done without a brass band to publicize it, should only add greater glory to the genuine accomplishment of this "five year plan" which really works.

No Time for Banker's Complex

"BANKER'S complex" with its two handmaids, timidity and deflation, has no place in utility management today. Of all businesses, that of supplying electric light and power has been least hard hit by the depression. And because of its quasi-public nature which almost classes it as a public servant, this business can least afford to get under the cloak of fear and apprehension that is today the greatest retardant to business recovery.

The electric light and power companies, through their executives, can play a prominent role in leading business out of the doldrums. Their net earnings have not been seriously affected; they possess undeveloped markets of tremendous possibilities; they know the value of long-term planning and continuous research; they are bearing the brunt of the attack which menaces the American principle of business and government and which this present depression threatens to materially strengthen; and finally they are in more intimate and positive contact with industry, people and communities than any other business.

This is not the time to curtail construction, simply because other industries are doing it. Prices of materials and efficiency of labor were never better suited for extensive construction programs. This is not the time to reduce wages or cut the working organization. Employee morale must be maintained at a peak. This is not the time to eliminate commercial programs or stint expenditures for new business. Experience has proved that every dollar spent to develop new loads brings back five in increased revenue within a year.

Courageous and alert leadership plus expert business management on the part of the utilities will do far more for the public than putting on a wry face and swelling the already loud chorus of blues singers.

Bid Peddling and the Profitless Prosperity

SUBMITTED to the Federal Trade Commission by the electrical contracting industry, a set of rules for fair trade practice has come back edited and somewhat invalidated. Not yet in their final accepted form, nevertheless, judging by the index of the rules accepted and rejected, the limitations of regulation of business practices detrimental to a business seem to be too well defined. Present laws were written to protect the consumer from the seller. They succeed so well that the time has come for some protection for business from the buyer.

Such a condition might not be serious were this not a nation whose whole economic life is bound up in the welfare of business. When business suffers from abuses of buying the entire institution feels the pain.

The rules relating to the regulation of competitive practices between competitors—deflation, enticement of employees, inducing breaches of contract, substitution of materials, adherence to codes, and the like—all were given robust approval. Those relating to architects, builders, general contractors and owners and the various devices used to intimidate, coerce and generally vitiate bidders—all practices ruinous to business and eventually costly to the public which usually pays anyway—were crossed off the list.

The rumble of protest against outmoded laws which restrain business in the wrong places comes not alone from the electrical contracting business. All private business in a competitive field is awakening to the realization that prosperity, when it comes, is profitless and therefore eats up reserves which might tide over depressions. The customer gets cheap prices, it is true, but at what cost to the institution of business which, after all, creates the living for the customer.

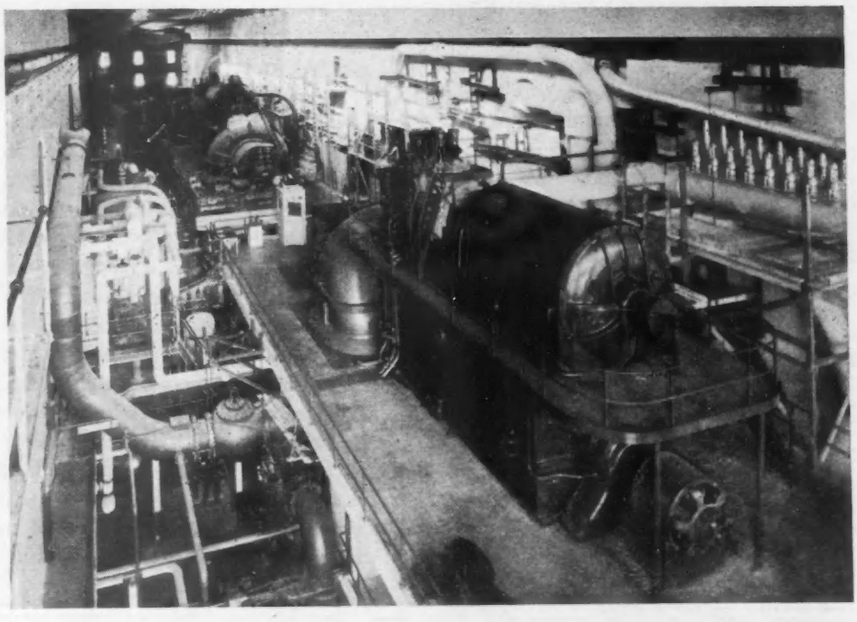
If the rumble becomes loud enough even the unbusinesslike ears of legislation may eventually be made to hear and take necessary action.

Tiger Creek power house

..."in the interests of its customers and the development of its territories"....

PACIFIC Gas and Electric Co. has just completed a noteworthy hydro-electric and steam construction program involving the expenditure of $50,000,000 which will add 230,000 hp. of new capacity to its lines. Thus has the company kept faith with the territory it serves. This construction program gave employement to 2,500 men when such work was vitally needed. It added $4,500,000 to payrolls. Machinery and materials were purchased which, in turn, gave employment to additional thousands of workers. The company has lived up to its policy of consistently anticipating energy demands on its system. Keeping in mind the interests of its customers and the development of its territory, the company has constructed these projects to provide more efficient service, hoping thereby that greater utilization of electricity will permit continuation of its past policy of lowering rates to its customers as conditions warranted.

A. F. HOCKENBEAMER, President
Pacific Gas and Electric Company



Generating units, Station "A"

Coordinated Power Development
on the
Pacific Gas and Electric Company System

SYSTEM planning and preparation for anticipated load growth are problems which require continuous study and exhaustive investigation. In line with its policy of keeping well in advance of energy demands, the Pacific Gas and Electric Co. has completed the major portion of an extensive expansion program which, to date, has added 171,000 kva. of generating capacity to its system and which provides for an additional 105,000 kva. within the near future. The economic and engineering factors involved in this development are particularly interesting, as the construction program included not only the installation of steam and hydro generating plants but also the coincident expansion of transmission, substation and distribution facilities necessary to deliver the energy to the consumer.

In July, 1930, the peak load on the Pacific Gas and Electric Co.'s system had reached 853,000 kw., the average yearly increment being about 7½ per cent, requiring the addition of approximately 60,000 kw. of generating capacity annually. This capacity, until recent years, had been supplied almost entirely from hydro-electric sources which, from the economic standpoint, had been satisfactory in producing attractive rates for the consumer of energy. Recently, low priced fuels have permitted steam plant economies which about equalize the cost of steam-generated and hydro-generated kilowatt-hours, giving impetus to the installation of steam-driven prime movers. This has resulted in the advent of the steam generating station as a definite factor in the economic operation of many Western power systems. an operating balance being effected by using hydro plants for base loads and steam plants for peaking and emergency demands.

That this relation between steam and hydro-generating plants is considered to be of primary importance by the engineers of the Pacific Gas and Electric Co. is illustrated in the results of their investigations, begun in 1926, to determine the sources from which energy requirements should be supplied. Two factors influenced the investigation. First, the 60,000-kva. increment of annual load growth was favorable to the development of hydro-electric projects as it permitted full utilization of a given stream over a short period of time and reduced the fixed cost per kva. so produced. Second, natural gas was available in quantities and at prices favorable to the development of large blocks of steam-generated energy.

Exhaustive study indicated that the most advantageous operating conditions from the economic viewpoint would be obtained through a program embracing the installation of both steam and hydro generating facilities. Primarily this program consisted of the complete development and utilization of the waters of the Mokelumne River, the construction of 220-kv. transmission lines from the project to a distribution point near the system load center around San Francisco Bay, the construction of substation capacity sufficient for distributing the power being made available, and the installation of not less than 100,000 kw. of steam capacity in Station "A" in San Francisco.

Subsequent discussion of the details of this interesting expansion covers the various phases of each development and is calculated to assist in a clear understanding of the engineering features involved and the important relation that the completion of each project bears to the remainder of the system. Reference to Fig. 1 will give an idea of the existing characteristics of the Pacific Gas and Electric Co.'s system. This diagram shows the generating plants, high-voltage transmission lines and important substations and their relation to the system load center,

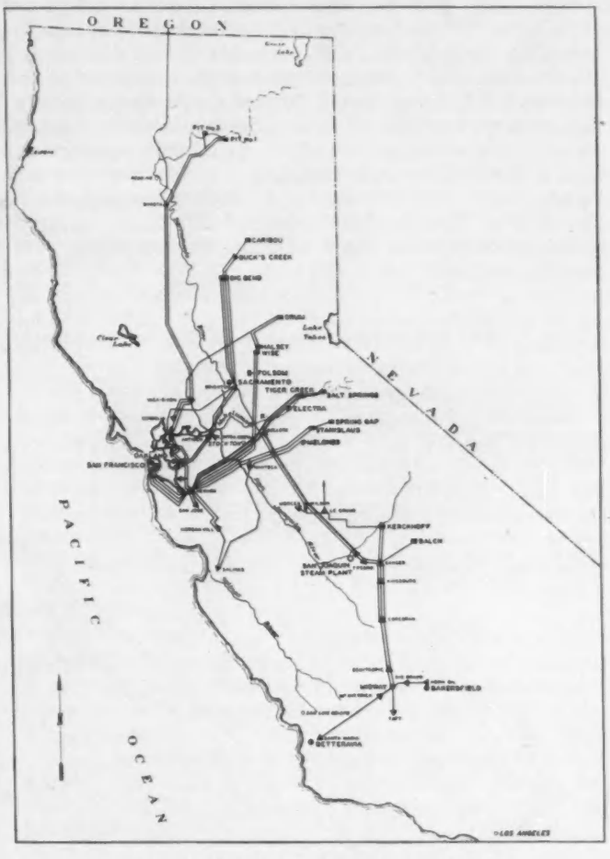


Fig. 1. Existing system characteristics

the Bay region around San Francisco and Oakland. From the diagram it is apparent that a complete installation from the river developments to the steam peaking and standby plants has been constructed as a unit to supplement the four other major hydro-electric developments of the company. With the completion of this program, Newark has become the key substation of the system, being the terminal of the high-voltage lines from plants on the Mokelumne, Yuba, Bear and Stanislaus Rivers, and the high-voltage distribution center for San Francisco and Oakland as well as other smaller cities down the coast.

Hydro-electric Development of the Mokelumne Basin

Highest of Its Kind, Salt Springs Rock-fill Dam Halts the Mokelumne River, Impounding Water to Produce Now 71,000 Kva., Eventually to Supply White Coal to Four Plants With 176,000 Kva. Installed Capacity

By **E. A. Crellin**

Assistant Engineer, Division of Hydro-electric and Transmission Engineering, Pacific Gas and Electric Co.

FACTORS governing the selection of the Mokelumne River as the most feasible hydro-electric project are interesting from both the historical and engineering standpoints. Its central location with reference to the remainder of the system, a flow adequate to the generation of large amounts of power, the availability of runoff records over a long period of time, and its storage possibilities made it the logical consideration for the proposed development. The stream has its source in the heart of the Sierra Nevada Mountains at El. 9,700, approximately twenty miles south of Lake Tahoe.

Since the construction of the first canals and the diversion tunnels in 1857, the Mokelumne River has been utilized successively for mining, irrigation, hydro-electric power generation and domestic water supply. Hydro-electric history of this river begins with 1902 when the Electra power house with an installed capacity of 28,000 hp. was placed in service and delivered its power over a 60-kv. transmission line to San Francisco. This was one of the pioneer hydro-electric and high-voltage transmission projects of the world and it is signfiicant that it has been in continuous operation since that date.

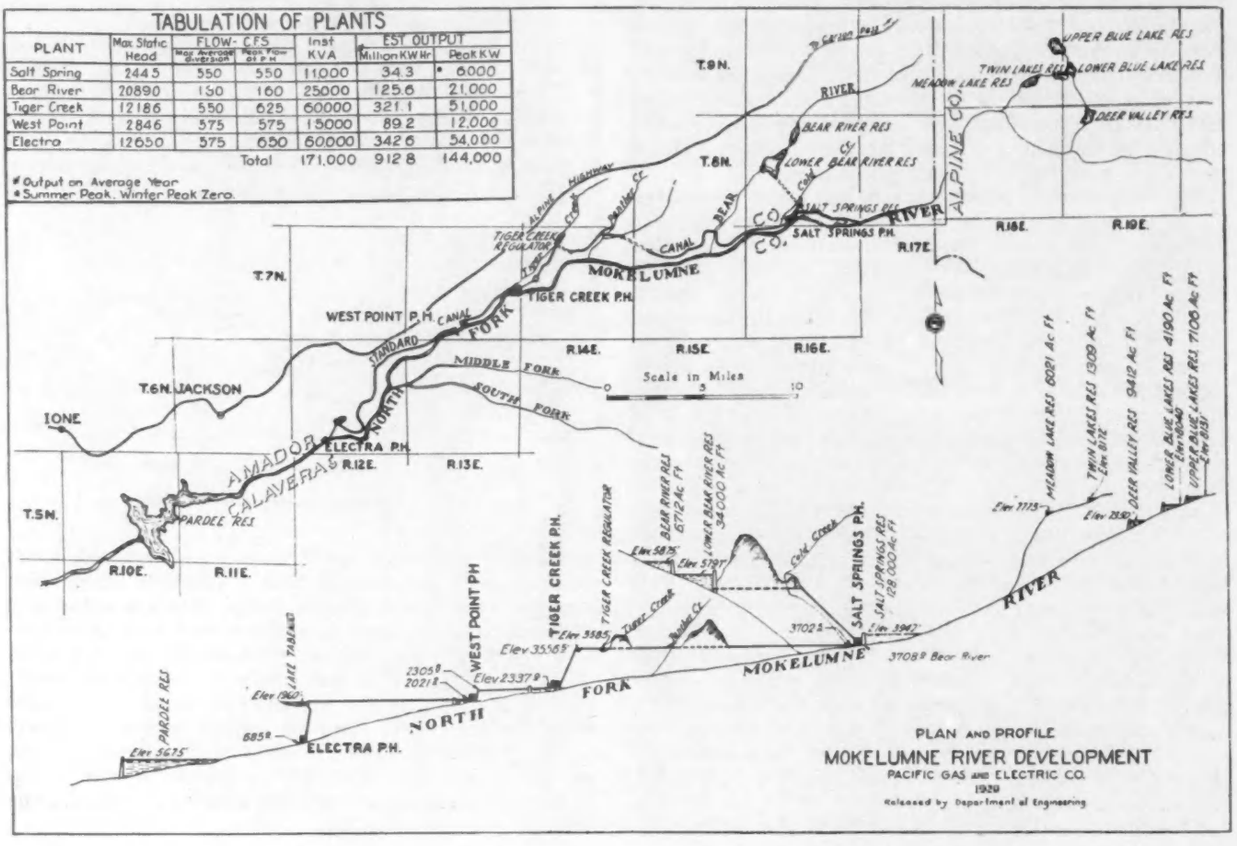
Storage facilities on this original installation total approximately 25,000 acre-ft. divided among several small reservoirs at high altitudes. Records of stream flow kept at Electra and an intimate knowledge of the topography of the watersheds obtained from surveys by company engineers indicated that, with the proper development, the Mokelumne River basin could be made to produce much additional power. Careful studies for increasing the stream output were then made and revealed that a storage of approximately 200,000 acre-ft.

Fig. 2. Plan and profile of Mokelumne River development

TABULATION OF PLANTS

PLANT	Max Static Head	FLOW- C.F.S. Max Average Diversion	FLOW- C.F.S. Peak Flow at P.H.	Inst KVA	EST OUTPUT Million KW Hr	EST OUTPUT Peak KW
Salt Spring	2445	550	550	11000	34.3	* 6000
Bear River	20890	130	160	25000	125.6	21,000
Tiger Creek	12186	550	625	60000	321.1	51,000
West Point	2846	575	575	15000	89.2	12,000
Electra	12650	575	650	60000	342.6	54,000
			Total	171,000	912.8	144,000

* Output on Average Year
* Summer Peak, Winter Peak Zero.



Forebay of Tiger Creek plant formed by excavating 200,000 cu.yd. of material from crest of hill. Sides and bottom of excavations were covered with a 3-in. gunite surface

could be obtained from the North Fork and its tributaries. From this source it would be possible to obtain 1,000,000,000 kw.-hr. annually.

To visualize the hydraulic possibilities of the river, reference to Fig. 2 is necessary. The proposed development specified a dam and storage reservoir of 130,000 acre-ft. at Salt Springs, the construction of a dam and reservoir on Bear River immediately below the existing Bear River reservoir, a 21-mile flume with necessary tunnels and siphons for conducting the water from Salt Springs to the junction of Tiger Creek and the North Fork of the Mokelumne, and two dams and canals to power stations farther down the river. Power houses were to be installed at Salt Springs, Tiger Creek and Westpoint, and Electra power house was to be rebuilt. A study of the profile of the river basin, shown in Fig. 2, clearly illustrates the method by which the production of power was to be accomplished and the magnitude of the development.

Work on this project was begun in 1928 on a schedule which called for completion in 1934 with an installed capacity of 176,000 kva. At the present time, a major portion of the development has been completed and Salt Springs and Tiger Creek power houses are delivering power.

Work on the development was carried on simultaneously from a number of points. Construction camps were established at Salt Springs, at the site of the Tiger Creek power house, and other advantageous locations. Preliminary construction consisted of building roads throughout the entire area, which was a virgin wilderness of formidable mountains, granite cliffs and dense forests. Railroad transportation ended at Martel, approximately 50 miles from the location of the Salt Springs dam, 20 of which were accessible along the Alpine highway. Supplies and materials had to be trucked from Martel to the scene of construction activity.

Salt Springs Dam and Reservoir

In discussing the river development, the construction of Salt Springs dam and power house is the logical point of introduction as it is the main storage reservoir from which stream flow and regulation are maintained. Located in the rocky gorge of the Mokelumne River, 40 miles above Electra, Salt Springs dam rises 328 ft. above the height of the streambed and has a crest length of 1,300 ft. It is the highest rock-fill dam in the world and contains about 3,000,000 cu.yd. of material, which is mainly loose granite rock quarried from the sides of the gorge adjacent to the site. With a base thickness of 900 ft., the upstream and downstream faces slope at the natural angle of repose of the material, the upstream face consisting of a layer of derrick-placed rock 15 ft. in thickness. This layer forms the foundation for a reinforced concrete facing placed so as to cover the entire upstream face and continuing into the solid rock foundation to a minimum depth of 15 ft. under the river channel and to proportionately lesser depth into either side of the canyon wall to the crest of the dam. This concrete face is 3 ft. in thickness at the base and tapers to a thickness of 1 ft. at the top of the dam, being reinforced by two layers of 1-in. steel bars on 9-in. centers in the lower section, and tapering proportionately to the height, until at the crest a single layer of the same sized bars on 13-in. centers is used. A 6-ft. cutoff wall extends from 6 to 20 ft. into the solid rock walls. As a further precaution against possible leakage through or around the dam, cement grout was forced under pressure into 2-in.-diameter holes drilled into the bedrock to depths varying from 50 ft., where the height of the structure exceeds 200 ft., to 25 ft. at the top of the dam, the spacing of these holes also varying from 6 to 10 ft., depending on the location.

The concrete facing was poured in sections approximately 60 ft. square using special steel forms suspended from the top of the dam. Each section is separated by an expansion joint approximately 1 in. wide. Joints are made impervious to water through the use of a sheet copper seal imbedded in the edge of the slab and extending into the edge of the adjacent section. Space above the seal is filled with an asphalt compound so that flexibility sufficient to accommodate settling of the material in the dam is incorporated without subjecting the concrete facing to unusual strains. Provision for settling which will occur over a period of time is made in the following manner. In plan, the upstream concrete face is slightly convex in the horizontal plane and slightly concave in the vertical plane. As maximum settlement will occur at the top of the dam, the curvature in the horizontal and vertical planes will tend to approach a straight line. In effect this design will keep the concrete facing in close contact with the rock foundation, will restrain any tendency to buckle outward, and any movement of the concrete sections will tend to close rather than open the joints between them.

Impounded water behind this dam will form a lake extending five miles upstream and having a storage

capacity of 130,000 acre-ft. A spillway capable of discharging 48,000 sec.-ft. of water is cut along the south wall of the canyon.

When construction work was first started on the dam proper a 22-ft.-diameter concrete-lined diversion tunnel was blasted through the solid granite of the right river bank to divert the entire stream flow around the dam. This diversion tunnel now forms part of the outlet works. At its downstream end two 10-ft.-diameter steel pen-

Downstream face of Salt Springs dam with Salt Springs power house in right foreground

stocks are inserted, each penstock being provided with an hydraulically operated butterfly valve and then extended into the river channel where each ends in another butterfly valve designed for free discharge. This arrangement permits unwatering the reservoir at the rate of approximately 10,000 acre-ft. per day in case of emergency.

Operation of the upper set of valves is provided for by means of an ingenious oil pressure system of the self-contained recirculating, accumulator type. Briefly, this system consists of the following equipment: Each butterfly valve is provided with an opening and closing cylinder, the pistons for which lie opposed on a common shaft. The arm operating the valve is attached to the center of this shaft so that any movement of the pistons produces a corresponding motion of the arm and opens or closes the valve. Oil under pressure is admitted from a common reservoir to each cylinder and since equalized pressures are thus provided on both sides of a rigidly connected system, the mechanical system remains in static balance. A control valve permits oil to be withdrawn from either the opening or closing cylinder, the resulting reduction in pressure at that point permitting motion of the piston in the desired direction. Oil pressure is maintained on this system by means of an accumulator which consists of a 125-ton concrete block and a series of pistons and valves closely resembling the operation of an hydraulic jack. The concrete block, which is free to travel between definite limits in a vertical direction, is the motivating force for a large piston, the opposite end of which acts directly on a pressure chamber in the oil line. The weight of the block is thereby transformed into oil pressure and, as this pressure depends solely on gravity for its maintenance, operation is assured as long as the block does not over-run its limit of travel. This contingency is provided for by means of a limit switch on the weight itself which energizes a motor-driven oil pump on a separate oil pressure system installed solely for the purpose of automatically raising the block to its proper position, should this become necessary.

Capacity sufficient to close both valves simultaneously under full operating head is incorporated in the valve operating system. Control valves are mounted in the accumulator building from which point the normal operations are controlled, but under emergency conditions the valves may be tripped from the power house itself, it being necessary to send a man to the accumulator installation to reopen them.

One of the 10-ft. outlet pipes branches into a 90-in. pipe and the other branches into a 72-in. pipe. One penstock supplies water to the generating unit installed in Salt Springs power house located a few hundred feet below the dam. The other terminates in a needle valve in which is incorporated an energy-absorbing baffle as this line discharges directly into the power house tailrace and acts as a bypass for supplying water to the Tiger Creek conduit when the Salt Springs generating unit is shut down or operating at reduced capacity.

Bear River Storage and Water Supply

Bear River, one of the principal tributaries of the Mokelumne, drains an area lying to the north and at a much higher elevation than the Mokelumne River. The plan and profile of the watershed shown in Fig. 2 will convey an idea of the relation between these two streams. At present there is a dam and reservoir on the upper

Upstream face of Salt Springs dam during construction showing placing of concrete and slab facing

reaches of Bear River and a second dam below the first is contemplated which will create the Lower Bear River reservoir with a capacity of 34,000 acre-ft. Utilization of the storage thus created will be made possible by a 2½-mile tunnel, piercing the ridge separating the two watersheds, which will terminate in a penstock leading directly to the Salt Springs power house. At the junction of the penstock and tunnel a surge chamber will be excavated in the rock, the top of this chamber being at a higher elevation than the water in Lower Bear Creek reservoir. This will permit the water from Cold Creek, a stream lying between Bear River and the Mokelumne, to be diverted into the surge chamber, thereby making the area above the diversion point on Cold Creek a tributary to the reservoir on Bear River.

From the water conservation standpoint this provides an ideal situation, for the water from Cold Creek may be diverted either through the turbine at the Salt Springs power house or backed up through the tunnel into the storage basin created on Bear River. As any spill from these sources in all probability will be diverted to the Salt Springs reservoir, it thus will be possible for the total runoff from the drainage areas of Mokelumne, Cold Creek and Bear River to be put to the maximum usage at Salt Springs power house.

Salt Springs Power House

SALT Springs power house, located a short distance below the Salt Springs dam, will utilize the water impounded in the Salt Springs reservoir which produces a maximum static head of 244.5 ft., and the water impounded in the Bear River reservoir which will be under a static head of 2,104 ft. The wide variation in head between the two sources of water necessitates that two types of generating units be installed in this station. For the lower head a vertical reaction turbine driving an 11,000-kva., 11-kv., 60-cycle, 300-r.p.m. generator is provided. This turbine is designed to pass 550 sec.-ft. of water at a head as low as 175 ft. In direct contrast to this unit utilization of Bear River will be accomplished by a single overhung horizontal impulse unit driving a generator rated at 30,000 kva. at 11,000 volts, 60 cycles, to be installed later.

The tail canal of the Salt Springs power house is, in reality, the beginning of a conduit leading to the Tiger Creek power house twenty miles downstream. As this conduit is designed for a 550-sec.-ft. flow, and as both units will discharge into this afterbay, it is readily discernable that constant flow of water in the conduit can be maintained under a widely varying kilowatt output from the station. According to system load requirements, water may be supplied to Tiger Creek from the 30,000-kva. unit, the 11,000-kva. unit, or from the bypass penstock in the outlet works of the Salt Springs dam.

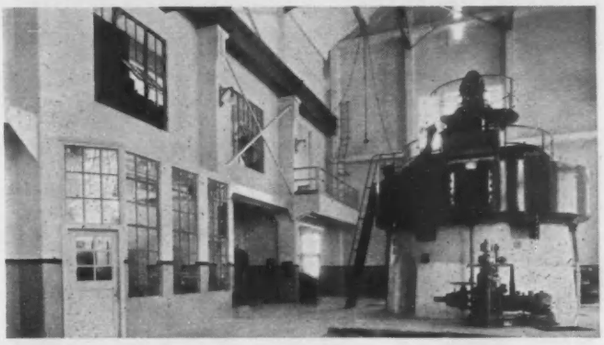
Normally all operations of the plant will be carried out on the main operating floor. The vertical reaction turbine-generator is installed at the extreme east end of the building. This unit consists of a Francis type, Pelton turbine driving a Westinghouse generator with its direct-connected main and pilot exciters. Ventilation of the generating unit is accomplished by means of an enclosed air circulating system with surface air coolers mounted within the stator enclosure.

Alongside of the existing unit, space is provided for the future impulse turbine unit which will utilize the water from the Bear Creek reservoir. Each of these units at Salt Springs will have its own individual oil-pressure governing system, the reaction unit governor now being actuated from duplicate gear-type oil pumps driven by electric motors, one pumping set being in reserve and arranged to start automatically upon failure of the other.

Plant operation is controlled from an operating room in which is mounted a bench type control board with its associated vertical instrument and relay panels.

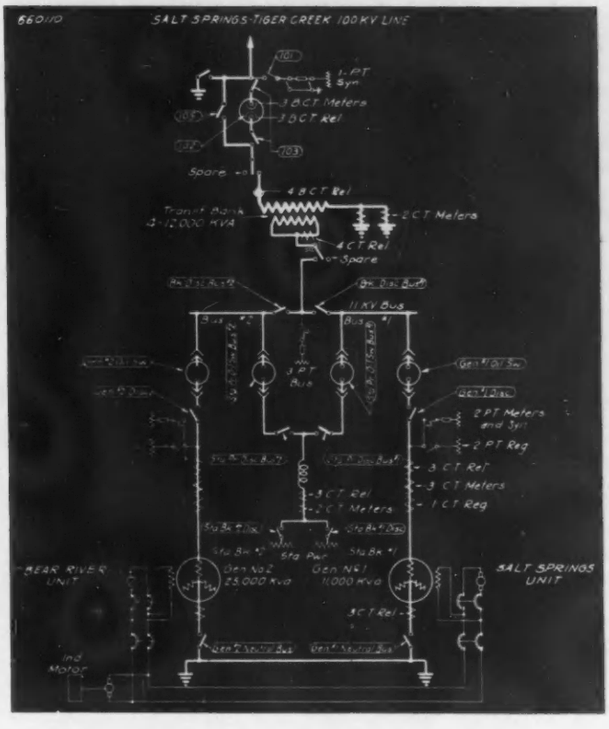
The low tension switching arrangement in the plant is simple, the generator leads connecting to the main bus through a single truck type oil circuit breaker. Two additional breakers feed power from this bus into the station power transformer bank. These two breakers are of the same size and type as the main generator breaker and, while they are far in excess of the capacity required for station service, the simplicity of arrangement and the immediate availability of a spare breaker more than

Exterior (left) of Salt Springs power house. Units discharge into Tiger Creek conduit to right of building. Interior (below) where horizontal unit will later supplement existing vertical generator. Switchboard room to the left



offset the added cost of this arrangement. Leads from the 11-kv. bus run directly to the primary of the step-up transformer bank which consists of three 12,000-kva., 11/110-kv. water-cooled transformers. A spare transformer is provided and so arranged through a system of air-break selector switches that it may be substituted for any unit of the bank without moving it from its installed position. High-voltage leads from the step-up transformer are fed through three 115-kv. multi-break oil circuit breakers into a single circuit transmission line which extends to the Tiger Creek switch yard.

Single line wiring diagram of Salt Springs power house

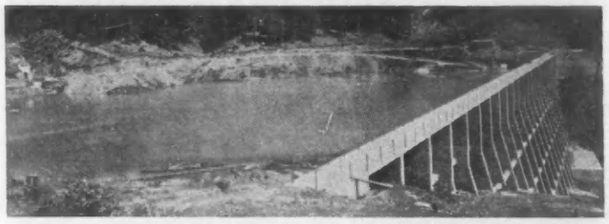


Tiger Creek Conduit

Piercing Mountains, Bridging Watersheds, the 21-Mile Aqueduct Brings Water Discharged From Salt Springs to Tiger Creek for Further Utilization. Permanency and Low Maintenance Insured by Special Concrete Flume Construction

This 93-in. siphon is used to convey flow across Deer Creek Watershed. Two such siphons are necessary to bring water to Tiger Creek regulator

WATER which is discharged from either of the turbine units or the bypass nozzle at Salt Springs power house is diverted into the Tiger Creek conduit which conveys it 21 miles to the forebay above Tiger Creek power house. For the greater portion of its length, the conduit is of bench-type concrete flume construction, topographical conditions making it necessary to supplement this construction with tunnels, stream crossings and siphons at various points. Along its route the conduit crosses a number of the smaller tributaries of the Mokelumne. The two highest stream crossings are accomplished by carrying the flume on arched concrete structures. The flow of these small streams is also diverted into the flume at these points by installing a small diversion dam and a steel or concrete feeder so that practically every drop



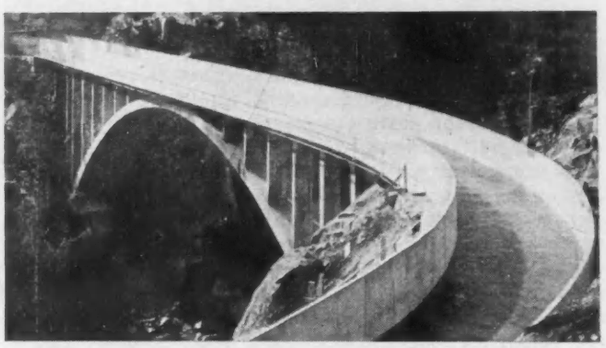
Regulating dam and reservoir located 2½ miles above Tiger Creek forebay. This buttressed slab concrete dam installed in the Tiger Creek watershed impounds that stream and the water delivered by the conduit through the tunnel shown at the extreme left

of water in the territory traversed by the conduit is utilized for power generation. Thus Tiger Creek power house will generate energy with the waters discharged from the Salt Springs power house, Bear River, Cold Creek, East and West Panther Creeks, Beaver Creek and Tiger Creek.

Briefly, the route followed by the conduit continues downstream from the Salt Springs plant to a point some ten miles below, where a tunnel is driven 9,150 ft. through the ridge into the watershed of East Panther Creek. The flume then continues to West Panther Creek where the water is conveyed across this draw by means of a siphon, then via flume to another tunnel, a siphon across Deer Creek and through a 2,800-ft. tunnel into the Tiger Creek watershed. At this point the Tiger Creek regulator is formed by a buttress slab concrete dam about 100 ft. in height. The waters delivered from the conduit and supplemented by the flow of Tiger Creek are here impounded to form a reservoir, the upper 14 ft. of which is used to provide a storage capacity of 175 acre-ft. This capacity is sufficient to permit peaking the Tiger Creek plant for about twenty hours each day, when full diversion is being made into the head of the conduit. Concrete conduit is again utilized to convey the water from the regulating reservoir to the forebay of Tiger Creek power house, a distance of 2½ miles. At the outlet from the regulating reservoir automatic gates are provided to maintain a constant flow in the conduit. One gate is under the control of the operator at Tiger Creek power house who thereby may limit the flow in the conduit to correspond with the load requirements on that plant.

As no natural forebay site was available in a location convenient to the Tiger Creek power house site, an artificial forebay was constructed by excavating approximately 200,000 cu.yd of material from the ridge above the power house. Storage capacity thereby provided is approximately 40 acre-ft., an amount sufficient to provide for peaking the Tiger Creek plant during the 30-min. interval required for water released from the regulator to reach the forebay. The entire excavation comprising the forebay is covered with a 3-in. concrete surface

Bear River arch crossing is typical of the construction used to support the conduit where canyons prevent the use of bench-type flume construction

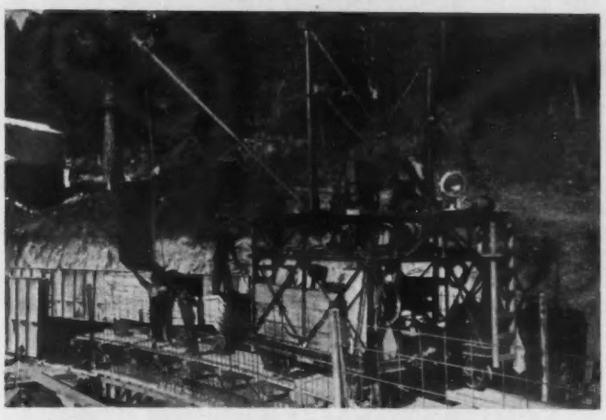


formed by a grout which was "gunited" into a reinforcing mesh.

Decision to adopt the conduit system between Salt Springs and Tiger Creek was arrived at after a thorough analysis of the engineering and economic factors involved in conveying the required volume of water over the relatively long distance between the two plants. Constants derived from the flow and distance indicated that some form of flume construction would be the most satisfactory for economic operating conditions.

Investigation of the most economical flume construction was then undertaken. The low first cost of wooden flume was somewhat offset by increased maintenance and loss of water through leakage. Concrete construction under conventional methods of erection showed an appreciably higher first cost but had the desirable characteristics of permanency and low leakage loss. Even with due allowance for these two desirable attributes, the advantage was somewhat in favor of the wood type construction from an economic standpoint. From the engineering standpoint, concrete was by far the more acceptable type of construction and the engineers of the Pacific Gas and Electric Co. determined to evolve some method of construction which would reduce the investment cost of a concrete flume.

Uniform characteristics and the length of flume to be constructed were favorable factors toward solution of



Special construction machine used to facilitate placing of steel forms used in the flume construction

this problem as permanent steel forms could be used and would eliminate much of the cost for labor and material in constructing and placing wooden forms.

Additional study evolved a new and entirely different method of concrete flume construction. So radical was the departure from conventional practice that it became necessary to design special equipment to accomplish it. Having determined, from the water requirements, that the size of conduit should have a section 7 ft. high and 14 ft. wide, special construction machinery was designed for these dimensions. For a greater portion of the distance, the flume is of the bench type and follows the winding configuration of the hillside. Three sizes of steel forms, 2, 3 and 4 ft. in width, were found to be sufficient to construct both the tangential and curved sections of the flume.

To expedite forming and pouring, a set of four machines was constructed. The framework of each machine was essentially the same and consisted of a structural steel frame approximately 15 ft. high and 20 ft. long which straddled the bottom section of the flume. Flanged wheels were provided on the bottom of the frame so that these frames could be propelled along a track laid close to the inner walls of the flume. The mechanism mounted

Pouring and mixing "jumbo" designed to speed construction operations. Dump car in foreground is pushed under the machine after discharging its load into the receiving bucket on the mechanism

on each of the four frameworks was designed to facilitate a definite group of construction operations, one being equipped to set the forms in place, the second combining the pouring and mixing mechanisms, and the third aiding in the removal of the forms after the concrete had set. All operations of the construction machinery were performed by electricity and each equipment was self-propelled.

On a second narrow-gage track laid between the tracks previously mentioned, trains of specially designed dump cars were propelled to the mixing mechanism from a central material-distributing point close to the main road. The completed section of the flume therefore acted as the roadbed for subsequent construction operations. These dump cars, which brought concrete and aggregate to the mixing mechanism, were designed so that pushing the body forward on the chassis overbalanced the load and dumped it into the receiving hopper on the mixer. The bucket then was raised on guides in the legs of the framework and dumped its contents into the hopper of the machine. Water was added and, after mixing, a series of spouts directed the mix to either of the side or bottom forms.

As the section of the flume was too small to permit an immediate return of the material-conveying cars, they were pushed between the legs of the mixing mechanism which was so designed as to permit this operation. Cars accumulated beyond the mixer until the entire train had disposed of its contents. The cars were pulled by a tractor and, as they operated within the flume, some method of returning the tractor to the head of the train had to be devised. For this operation, the fourth of the steel frameworks was equipped with a sling and hoist which lifted the tractor over the cars, reversed its direction and deposited it at the head of the train for the trip under the mixer and back to the material center.

Several sets of the equipment described above were constructed and the operations on the flume were carried on from a number of points along its route.

Aside from the flume itself, seven tunnels totaling 2½ miles in length, several arch-type crossings, and two 93-in.-diameter steel siphons completed the hydraulic works necessary to bring the water into the Tiger Creek regulator. In addition, a number of crossings and escapes were necessary to permit wild animals in the locality to cross the flume and to escape from it in case they should accidentally fall in.

The grade on this portion of the conduit is 0.8 ft. per 1,000 ft. of run. From the regulating dam to the forebay flume construction was carried out in the same manner as described above, the grade on this portion being 1 ft. per 1,000 ft. of run.

Tiger Creek Power House

FROM the forebay, excavated on the promontory above the site of Tiger Creek power house, the water enters a single steel penstock 4,750 ft. in length and varying in diameter from 102 in. at the top to 72 in. at the wye outside the power house. The upper 4,000 ft. of the penstock is of riveted steel pipe with the rivets countersunk on the inside. Seamless steel pipe, each section rolled from a pierced steel ingot, comprises the last 750 ft. of the penstock. All joints were welded internally and externally and, after sandblasting, the interior was painted with two coats of Wailes Dove-Hermicton Bitumastic compound, the first being a primary coat and the second a finish enamel. Siphons were similarly treated.

The penstock terminates in a double wye, branching first into two 52-in.-diameter lines, each of which again divides into two 36-in.-diameter lines. As the two units in Tiger Creek power house are of the double overhung impulse wheel type, each generating unit is served by two of the 36-in.-diameter penstocks. The turbines in this station operate under a net effective head of 1,190 ft.

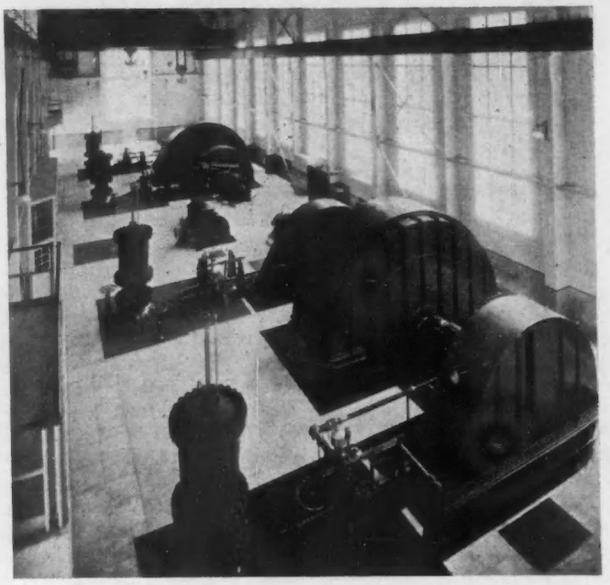
Tiger Creek power house is the controlling station for the 220-kv. transmission line carrying the power generated by the Mokelumne River to Newark substation near San Francisco. As these lines are approximately 125 miles long and require 25,000-kva. charging capacity, the minimum generator capacity for a single unit was fixed at that figure. This limitation and the head and quantity of water available indicated that a two-unit installation would be the most desirable.

Maximum generating capacity for this plant was installed in the initial installation. Each waterwheel unit consists of two overhung impulse Pelton wheels rated at 18,000 hp. Each generating unit consists of a 30,000-kva., 11,000-volt, 60-cycle, 225-r.p.m. Westinghouse generator with direct-connected main and pilot exciters. The turbines driving these units approach maximum size practical for the head available at Tiger Creek and in physical dimensions rank among the largest impulse wheels ever constructed.

Refinements incorporated in the design of the turbines reflect the most modern engineering practice. Uniform jets delivering maximum power to the waterwheel buckets with a minimum disturbance to water flow are made possible by a new design of straight-flow needle nozzle. The governing mechanism is operated by the governor servo-motor and permits slow closure on load rejection as a water conservation measure in much the same manner as the relief valve closes in large hydraulic installations.

Linked with the governor and needle operating mechanism is a jet deflector or stream bender in the form of a collar surrounding the jets which operates to remove the jet from the wheel instantly upon load reduction. In conjunction with the slow-closing needles, this combination of jet deflector with the governing mechanism is ideal for an impulse wheel installation, as it makes it possible quickly to divert the water from the wheel without disturbing the flow of water in the penstock with its attendant surge. Economies thus made possible are reduced penstock cost and omission of a surge chamber.

In appearance and general layout, Tiger Creek power house is similar to Salt Springs. At Tiger Creek, however, the arrangement is still further simplified by treating each of the two generating units individually, each impulse wheel having its own governing mechanism. Duplicate oil pumps supply the governor oil pressure system, one electrically-driven for normal use and the other water-driven for emergencies.

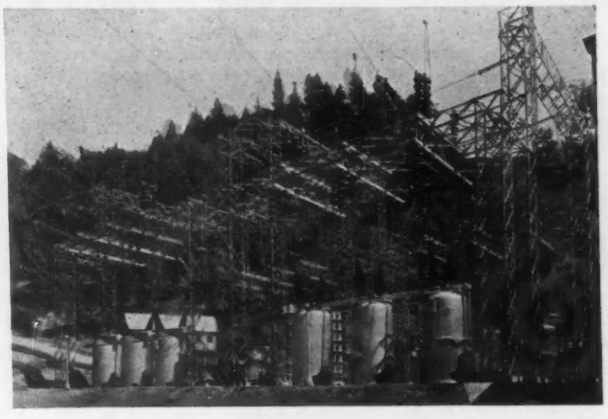


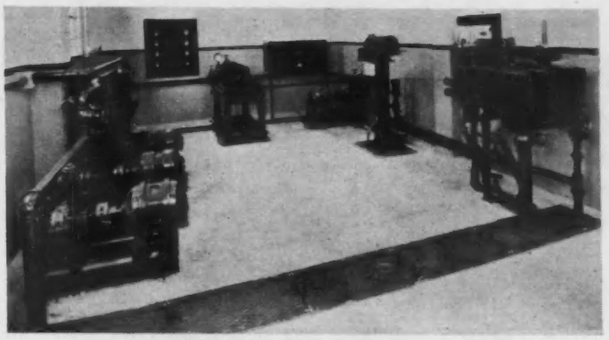
Station interior showing the two 30,000-kva. units, each being driven by double overhung impulse wheels with individual governing mechanisms. Switchboard room at left

Each of the main generating units has its direct-connected exciter and pilot exciter. Installed between the two main generating units is a spare exciter driven either by an induction motor or an impulse waterwheel.

The rear of the building is devoted to housing the auxiliary equipment, low-voltage bus structure, and its associated switching equipment. The switchboard is located on the level of the generator floor midway between the units. All control is mounted on a bench type switchboard with the necessary meters and instruments mounted on vertical panels in the same room. In addition, all other equipment requiring frequent attention, such as oil purifying apparatus, battery and charging equipment and others, is installed on the main power house floor to facilitate operation. From the operating standpoint, the time and study devoted to securing a con-

Switchyard and bus structure from which the combined output of Salt Springs and Tiger Creek is transmitted at 220-kv. to Newark



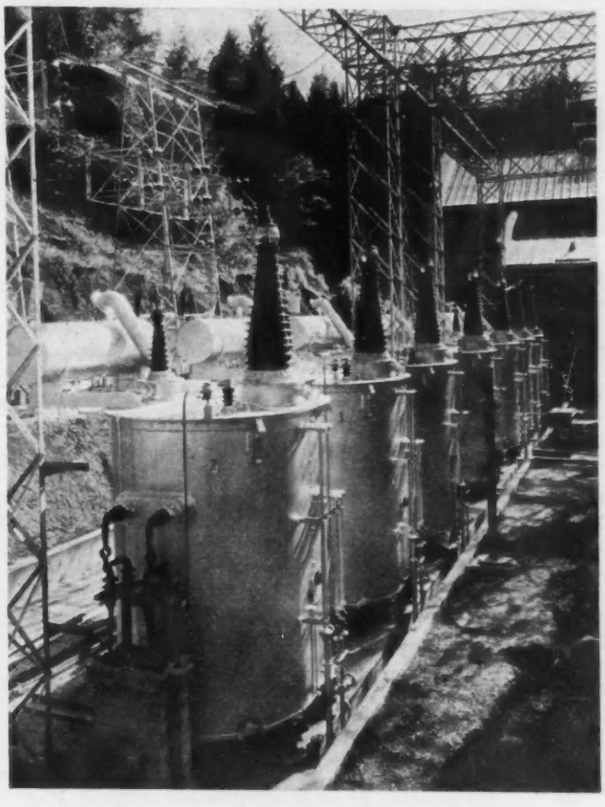


A complete piping system connects oil chambers of all major apparatus to this oil-conditioning equipment

venient location of all equipment should result in a direct economic benefit.

Above the rooms housing the switchboard and auxiliary apparatus the low-tension switching equipment is installed. While comparatively simple, the arrangement of the power circuits at Tiger Creek differs from the conventional method in many respects. Generator leads are carried directly to the transformer bank serving that unit, no oil circuit breakers being installed in the circuit. An 11-kv. bus structure, steel enclosed, is connected between the two generator circuits for synchronizing and for station service. Four 11-kv. truck-type oil circuit breakers are installed in the bus room which is directly over the switchboard room. Two of these breakers serve to tie the two generators to the 11-kv. bus for the purpose of synchronizing. The two remaining breakers supply the station power transformer bank from either side of the 11-kv. bus. These four breakers are all interchangeable, thus providing ample spare circuit breaker equipment. Under normal operations, when the generating units are in parallel on the high side of the transformers, one of the tie-in breakers is opened so that each generating unit with its associated bank of transformers operates as an independent unit which furnishes power to one of the two circuits of the transmission line. Reference to the accompanying diagram will disclose the latter point, the individual unit arrangement being carried from the generator through the step-up transformer and on to one of the two circuits of the 220-kv. Mokelmne transmission line to Newark substation.

Two banks of transformers step-up 11-kv. Tiger Creek power to 220-kv. Each transformer has 110-kv. auto transformer tap in its secondary for input received from Salt Springs



Behind the Tiger Creek power house is the switch yard with its associated high-voltage switching equipment. Power is supplied to this point both by means of the 110-kv. transmission line from Salt Springs power house and from the two generating units at the Tiger Creek power house, and from this point the two Mokelumne-Newark transmission lines take off. Of particular interest are the two main transformer banks. Each bank consists of three transformers which are provided with a combined two-winding and auto-transformer winding. The tertiary winding on each unit has a capacity of 10,000 kva., giving 30,000 kva. per bank which is sufficient to care for one Tiger Creek generator. Power is fed into this winding at the station voltage of 11 kv. The secondary winding acts in two capacities, serving both to step up the 11-kv. primary power received from the Tiger Creek generators to 220-kv. and acting as an auto-transformer to convert incoming power at 107.5 kv. from Salt Springs power house to 220 kv., having 10,000 kva. of capacity for each of these functions. Each transformer bank therefore has a capacity of 60,000 kva., 30,000 kva. for one Tiger Creek unit and 30,000 kva. for power received from Salt Springs, and thus is capable of carrying both the normal output from Salt Springs as well as the output from one Tiger Creek generating unit. Seven of these transformers are installed, one spare being located between the two banks. Primary connections are made on the side of the tank to permit the 110- and 220-kv. connections on the top cover.

Power from Salt Springs terminates at a 110-kv. bus structure. Two 110-kv. oil circuit breakers permit connection to either of the Tiger Creek transformer banks. From the high voltage side of the main transformers the 220-kv. bus continues through four 220-kv. oil circuit breakers. Two such breakers are inserted in each line, with a 220-kv. motor-operated, air break switch, controlled from the Tiger Creek switchboard acting as a tie between the two circuits.

Because of the special arrangement of both the high- and low-voltage circuits at this station, the relay protection also differs in many respects from conventional practice. Generators are differentially protected, but as they are connected directly into the transformer bank which may also be receiving power from Salt Springs, to clear the unit it is necessary to trip the breakers in the Salt Springs circuit, the 220-kv. breakers in the Mokelumne circuit, the bus-tie breakers and, in addition remove excitation from the machine and close the valves to the turbines.

The main transformer banks are protected by a relay arrangement which duplicates the foregoing operations. Each primary is protected by balancing current flow in the primary leads. As the secondaries are energized both from the primary and the Salt Springs tie-in, the protection is somewhat similar to an auto transformer in that current on the two outgoing 220-kv. leads is balanced against the current to the center part of the winding received from Salt Springs at 110-kv., current transformers being selected to correctly maintain this ratio.

On the main operating floor complete oil conditioning apparatus is installed. Two De Laval centrifuges, a

filterpress and a dryer permit transformer oil, lubricating oil and governor oil to be treated. Transformer oil is stored in two large tanks installed behind the power house, and storage tanks for governor and lubricating oils are installed in the basement of the power house. A system of piping and centrifugal oil pumps permits conditioning of the oil in any piece of apparatus with the minimum of delay and without relieving the unit from service, as fresh oil may be pumped from storage to the apparatus, or its oil may be circulated through the conditioning equipment.

Water discharged from the impulse units at Tiger Creek flows into an afterbay formed by a concrete arch dam about 100 ft. in height two miles below the power house on the Mokeulmne River. This creates a reservoir with 300 acre-ft. of capacity which will be used to re-regulate the Tiger Creek peak and natural runoff from the Mokeulmne River below the plant. From this combined afterbay and reservoir water will flow both to the contemplated power house at West Point and the existing Electra power house.

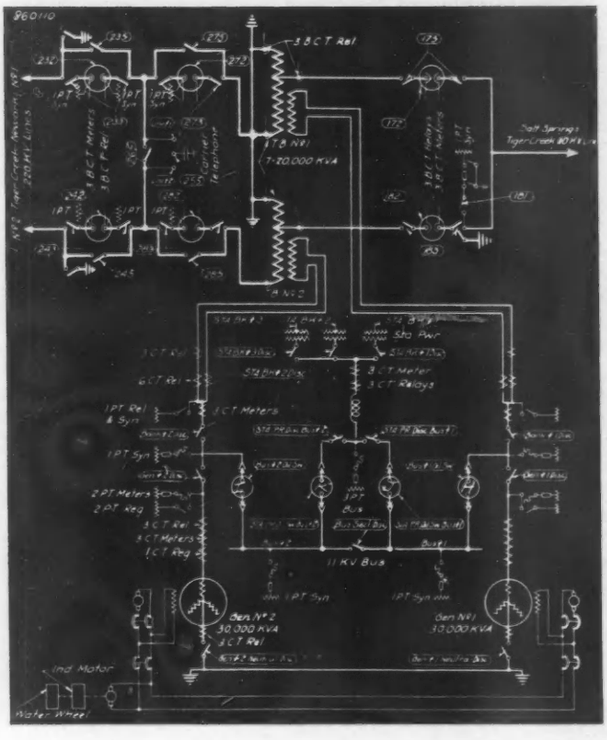
West Point and Electra Power Houses

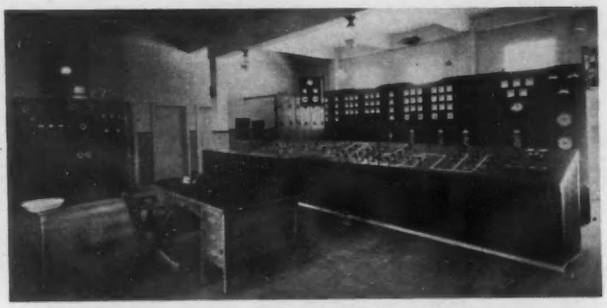
Discussion of the Electra and West Point power houses is taken up somewhat in reverse order, due to the fact that the conditions surrounding the operation of the present Electra power house make it necessary to complete the river development in that order.

The existing Electra hydro plant is supplied with water through two conduits known as the Upper Standard Canal and the Lower Standard Canal, the latter having been constructed during the early mining days and delivering water from the Mokelumne into Lake Tabeaud which forms the forebay for Electra power house. Later, the upper canal was constructed at an elevation 200 ft. higher than the first and terminated in Petty reservoir, forming a second forebay for Electra.

More efficient utilization of the river flow will require

Circuits whereby unit operation of each generator, transformer bank, and transmission circuit is accomplished. Generators tie directly to transformer primaries, being synchronized through 11-kv. bus-tie breakers





Bench-type control board with vertical instrument-relay panels in rear

the construction of a new conduit to supply a plant which will be built at the site of the existing Electra station immediately after the completion of the Salt Springs-Tiger Creek development. To construct this new conduit above the existing canals would entail several disadvantages, the most important of which are the lack of a forebay site at Electra and the impossibility of keeping the existing canals free from debris of excavations.

This contributed to the decision to build the new conduit from the high water level of Tabeaud reservoir along a rising grade of 0.8 ft. per 1,000 ft. until this grade intersects the river gradient. The point of intersection is approximately four miles below the Tiger Creek afterbay dam, necessitating the construction of approximately 13.7 miles of conduit for this purpose. Conforming to this plan permits operation of the existing canals and power house during the entire period of construction of the conduit and, at the same time, will permit diverting the water from the river into the new conduit and frees the Upper Standard Canal for construction work necessary for the completion of West Point power house.

As the conduit from West Point to Electra will have a capacity of approximately 575 sec.-ft., and as the head from Lake Tabeaud to Electra is approximately 1,275 ft., the hydraulic conditions at Tiger Creek plant are practically duplicated there so that the new Electra plant will be almost a replica of that station. However, the presence of an excellent forebay in Lake Tabeaud with a capacity of 1,158 acre-ft. will permit considerable peaking by the new Electra plant and the power house will be designed so that a third unit for peaking purposes may be added at a later date if economies and system load requirements indicate the desirability of this action.

From the Tiger Creek afterbay another canal will be built following the location of the present Upper Standard Canal for a distance of four miles, to the location of the proposed West Point power house. As no forebay is available at this point, the new plant will operate at 100 per cent load factor under a static head of 285 ft. and a maximum flow of 575 sec.-ft. This will permit the development of 15,000 kva. at this point. The new plant will be laid out for full automatic operation with certain controls carried back to the Tiger Creek power house. The power generated here will be stepped up to 60 kv. to supply the demands now served by the present Electra plant which will be dismantled upon the completion of the new plant at that site, the new plant feeding directly into the 220-kv. transmission system already completed.

Complete utilization of all the waters in the Mokelumne watershed will be made possible upon the completion of this project. Water therein begins its useful career of power generation at the Upper Bear River reservoir, El. 5,875-ft., and continues through the stages outlined until it is released at the tailrace of Electra power house, El. 685 ft., to enter Pardee reservoir of the East Bay municipalities for further utilization as domestic water supply.

Two 220-Kv. Lines Bring Power to Newark

By E. M. WRIGHT
Assistant Engineer, Department of Hydro-electric and Transmission Engineering, Pacific Gas and Electric Co.

Varied Loading and Insulation Requirements Influence Design of Each Section of the Line; Two Circuits Operating Under Identical Conditions Offer Opportunity for Comparing Different Classes of Insulation

CONSTRUCTION of transmission facilities necessary to bring the Mokelumne power to a distributing point for system use was carried out on a schedule which called for completion at the time Tiger Creek and Salt Springs power houses were ready for operation. Aside from its apparent economy, 220 kv. was selected as the operating voltage for the section of the line between Tiger Creek and Newark substation, as this voltage would simplify future interconnections and would bear a more favorable relation to the existing high-voltage network of the company.

In this connection it will be noted (Fig. 1, page 53) that the Mokelumne lines cross the double circuit 220-kv. line from the Feather River hydro-electric plants to the San Joaquin Light & Power Corp. substation near Fresno and that they parallel for the last half of their length two 110-kv. double-circuit power lines, one from Spaulding-Drum and the other from the Stanislaus hydro developments. To permit interconnection with the lines from power houses on the Pit River and entering the Bay district via the Vaca-Dixon substation, the receiving voltage was set at 200 kv. Voltage at the sending end was set at 215 kv. so that generators would operate at unity or lagging power factor, and thereby require the high excitation essential for good stability. Under this condition a charging current would be supplied from the receiving end of the transmission line.

In the 109 miles traversed by the Mokelumne transmission line, two general types of towers and two types of conductors are used. Over its length three types of loading and three zones of insulation are provided.

From the switch yard at Tiger Creek the heavy loading area continues for sixteen miles through the mountains. In this section each of the two circuits is mounted on a separate tower line and is designed for ice loading of ½ in. with a 6-lb. per sq.ft. wind at 0 deg. F. Supporting structures are snow towers 57 ft. 4 in. in height set in concrete foundations. These permit a flat configuration of the conductors spaced at 20 ft. Ten-in.-diameter, standard-strength insulators in thirteen-unit strings are used for insulation on the tangents, with strain and dead-end-point insulation consisting of strings of thirteen 11-in. high-strength insulators. To take care of the heavy loading, aluminum cable, steel-reinforced conductors of 518,000 circ.mil area were selected. Standard compressor joints were pressed on in the field for all splices in this section.

The remaining eleven miles to Valley Springs is in the medium loading area where the line is designed for ¼ in. of ice with a 6-lb. per sq.ft. wind at 0 deg. F. Supporting structures for this section are of the two-circuit steel tower type with crossarms arranged to give a semi-vertical configuration. Each circuit is carried on one side of the tower, the vertical spacing between conductors being approximately 15 ft. The top and bottom wires of each of the two circuits carried on the tower have a spacing of 28 ft., the 5-ft. offset in the center conductor giving a 38-ft. spacing between these two wires. Conductors and insulation conform to the same specifications as for the heavy loading section of the line.

The light loading area is that between Valley Springs and Newark substation, a distance of 82 miles. Designed for an 8-lb. per sq.ft. wind at 25 deg. F., this section of the line is divided into two parts as far as tower and insulating characteristics are concerned. Roughly, the

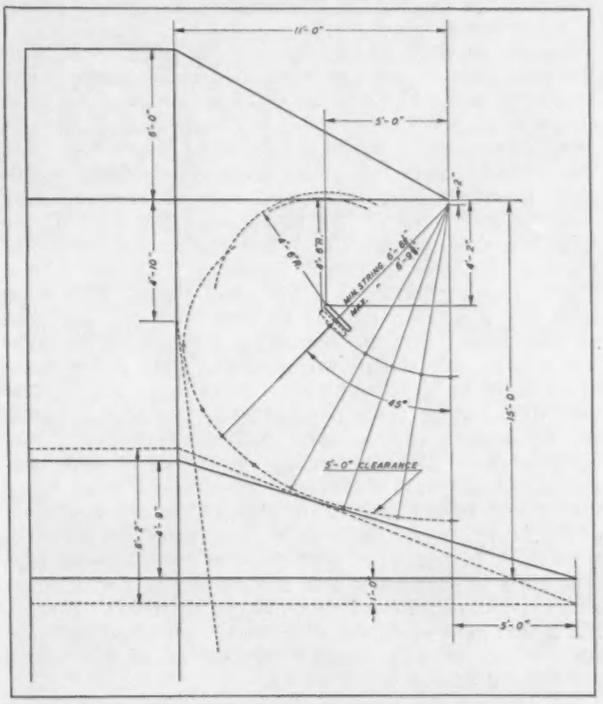
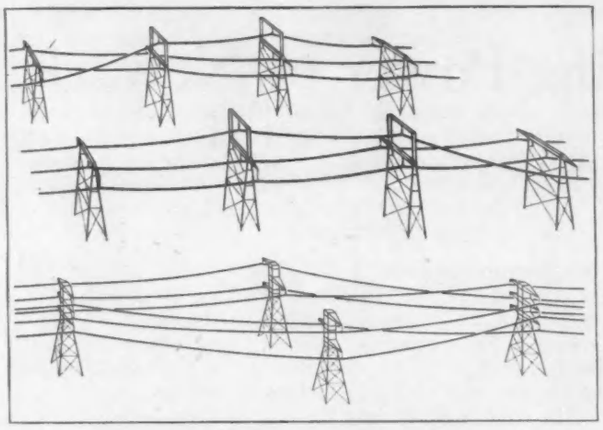


Diagram showing method of determining clearance requirements between conductor and tower. Standard 220-kv. strings are 6 ft., 6½ in. and 6 ft., 9⅝ in. long and maximum insulator swing is 45 deg. with the vertical angle of conductor 20 deg.

first part extends from Valley Springs to Tracy, a distance of 53 miles. In this section towers are of the same general design as used in medium loading areas except that the offset center crossarm is replaced with a standard crossarm. Conductors are therefore in a vertical configuration with a 28-ft. spacing between circuits. Towers on the 29-mile section between Tracy and Newark have the same steel section below the crossarm but are equipped with an extra long crossarm giving a 33-ft. horizontal spacing between circuits and permitting increased insulation, as this section is subject to fog. Throughout the entire light loading area, whose length dictated that conductivity and low corona loss were of primary importance, hollow-core 500,000-circ.mil copper conductor was chosen. All splices are screw joints and



Method of making transpositions without the use of dead-ends on the single- and double-circuit towers

consist of threaded lugs drawn on the ends of the conductor at the factory and connected in the field by means of a sleeve nut.

Insulation from Valley Springs to Tracy consists of the same type of units as were used in the medium and heavy sections. From Tracy to Livermore, a distance of eleven miles, the line is subject to frequent light fogs and from Livermore to Newark subject to heavy fog. The two circuits operating under identical electrical conditions therefore offer the opportunity of experimenting with various types of fog insulation. For half of the light fog area, circuit No. 1 was equipped with twelve units of fog-type insulators 10 in. in diameter with a 6¼-in. spacing having a 3¼in. shell droop. This insulator has a smooth outside surface with one petticoat on the inside. For the remaining distance in the light fog section, this circuit was equipped with eleven units of 10-in. disks, spacing between disks being 7½ in. and each disk having three petticoats on the outside and a smooth inside. In this same section, circuit No. 2 was equipped with insulator strings consisting of seventeen standard units with seventeen high-strength units being used for dead-end and strain strings. In the first half of the heavy fog section between Livermore and Newark, circuit No. 1 is equipped with thirteen 7½-in. spaced fog-type units in suspension and for the last half with fourteen 6¼-in. spaced fog-type units in suspension. Circuit No. 2 was here equipped with twenty standard units in suspension, using a similar number of high-strength units for dead-end construction.

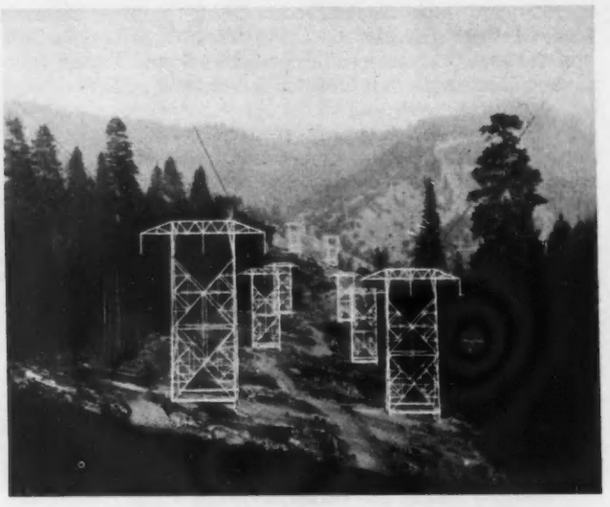
As comparison between lines operating with from seventeen to twenty standard insulator units with that of a line equipped with two different designs of fog-type units is made possible through this insulation, useful information relative to the values of standard and fog-type units will be made available.

Insulation hardware throughout the line consists of bolted type "J" and "U" bolt clamps, thus eliminating any cutting of the conductors for dead-end construction. Clamps were so selected as to contact with the conductors for not less than 80 per cent of the conductor circumference.

As an illustration of the thorough study which was made to determine the most advantageous operating characteristics for the line, extensive tests were made in the high-voltage laboratories of Stanford University to determine corona losses on various sizes of cable operating on a three-phase, 220-kv. circuit under all weather conditions. These tests resulted in the selection of a conductor with a diameter of 1 in. Further precaution against corona losses was taken by adding a curved pressed steel shield at the end of all 220-kv. insulator strings.

At the point where the Mokelumne transmission line crosses the Feather River transmission line, a switching station has been installed tying in both Mokelumne circuits to a bus from which one circuit is carried on the Feather River line south to the San Joaquin Light & Power Corp. substation near Fresno.

In addition to the Mokelumne lines, the construction project required the installation of seventeen miles of single-circuit, 110-kv. transmission line between Salt Springs and Tiger Creek power houses. This voltage was selected because the amount of power to be transmitted and the distance of transmission did not warrant the use of 220 kv. As this line was in the heavy loading area, snow towers set in concrete foundations were used. In general, the construction details of the line are much the same as those of the Mokelumne transmission circuits. Conductors are in flat configuration and consist of 4/0 seven-strand, hard-drawn bare copper wire, except in a few long spans where "Hitenso" copper was used to supply the additional strength. The line is equipped with insulator strings consisting of eight 10-in. standard strength units with nine units being used at dead ends.



Structures used in heavy loading area. Two single-circuit towers set in concrete foundations support conductors in flat configuration with 20-ft. spacing

At points of excessive strain insulator strings of nine 11-in. high strength units were used.

Spacing of the transmission towers on both the 220- and 110-kv. lines are 600 ft., while the two-circuit steel towers on the lower end of the Mokelumne line are spaced for an 800-ft. span length. A number of spans vary in length from 1,000 to 1,800 ft., but it is interesting to note that no dead-end or semi-strains are used unless required for angles, upstrain, or crossing, the increased strength necessary at these points being supplied by a specially designed supporting tower.

Transpositions, where snow towers are the supporting structures, are of the rolling type without dead end and are completed in three normal spans by carrying one outside wire over the top of the other two on extensions attached to the top of the two standard towers. On sections of the line supported by the twin-circuit structures, transpositions are made by separating circuits and adding an extra tower at the center of the transposition. This necessitates the use of two towers with special crossarms at the center point of the transposition but permits a "rolling type" transposition without a dead end.

Newark Now System's Key Substation

Power Concentration at This Point is Among Largest in the United States

By B. D. DEXTER
Assistant Engineer, Department of Hydro-electric and Transmission Engineering, Pacific Gas and Electric Co.

LOAD conditions in 1919 on the Pacific Gas and Electric Co.'s system required the construction of a switching center in the San Francisco Bay area to facilitate the distribution of power, the requirements for which had grown rapidly in the preceding years. At that time a site at the extreme southern tip of San Francisco Bay was selected as the location for the new station. Subsequent developments have proved the wisdom of this decision and today Newark may be termed the key substation for the system as the present installation there permits power exchange from all of the major hydro-electric developments on the system and the larger steam plants in San Francisco and Oakland.

Newark is the terminal point for transmission lines from the plants on the South Yuba-Bear River development, Mokelumne River development, and Stanislaus River development. In addition, a two-circuit, 110-kv. transmission line to Claremont substation in Oakland provides a direct tie with the Pit and Feather River power plants. Incoming lines consist of two 220-kv. circuits from Tiger Creek, six 110-kv. lines, two each from Stanislaus power plant, Drum power plant, and Moccasin Creek, and one 60-kv. line from Electra power house, and make the power concentration at this point one of the largest in the world. From this substation ten 110-kv. transmission lines take off, four going to San Francisco, two each to San Jose and Morgan Hill, and two completing the tie-in with Oakland at Claremont substation. San Francisco is served also by two outgoing 60-kv. circuits.

For flexibility and economy in switching operations, the Pacific Gas and Electric Co. has selected a double bus arrangement for the 110- and 220-kv. buses at this station. In general, this arrangement consists of a double bus structure with bus selector air switches and a bank of three single-pole oil circuit breakers for each transmission line and transformer bank. An extra circuit breaker bank permits paralleling the bus so that a circuit can be connected to either or both buses as switching requirements may dictate.

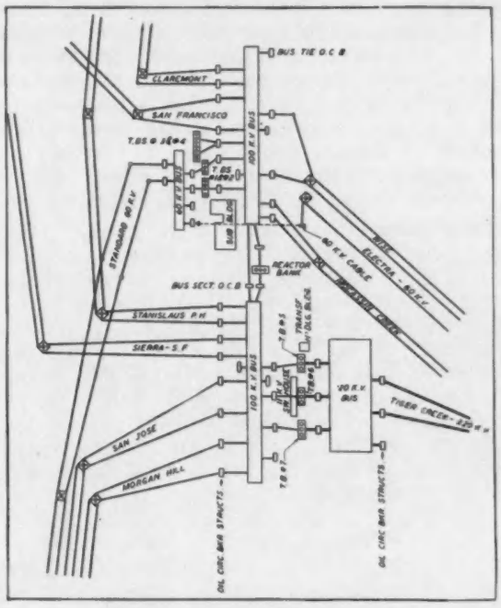


Fig. 1—Circuit diagram of Newark substation

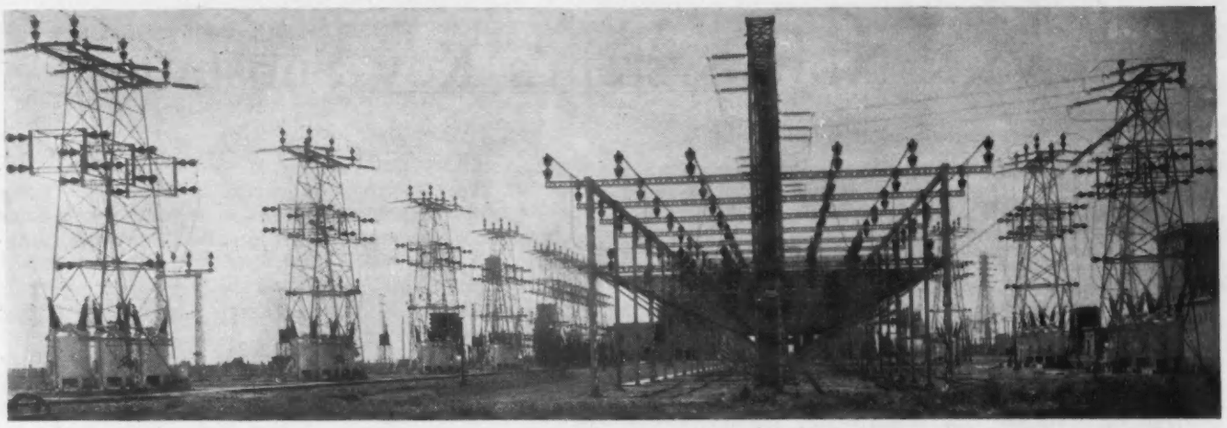
With the advent of the 200-kv. circuit from Tiger Creek, it was necessary to add a 200-kv. bus structure to the existing equipment at Newark. This bus structure is made up from galvanized steel members and is 354 ft. long, 116 ft. wide, and 64 ft. high to the center of the dead-end frame. Switching facilities for two 200-kv. transmission lines, three transformer banks and the bus paralleling circuit are provided. On one side of the bus structure incoming-line circuit breakers are located. Each transmission circuit is dead-ended with strings of twenty 10-in.-diameter insulators on a galvanized structural steel tower which supports the bypass and disconnecting switches for the oil circuit breaker bank serving that circuit. This structure is 60 ft. high, 64 ft. long and 17 ft. wide. Within the area so enclosed three single-pole, oil circuit breakers of the six-break type, rated 600 amp. at 220 kv., are mounted.

As shown in the accompanying illustration, the switch-arrangement provides a bypass air break switch of the vertical type mounted on top of the structure. Disconnecting switches for the circuit breaker are of the vertical "roller-skate" type, the moving insulator and contact being carried on a small wheeled truck which moves in horizontal guides near the top of the tower. On towers carrying the incoming lines, grounding switches are installed and interlocked with the bypass switches, the ground switch contact closing into a contact on the center post of the bypass switch. All switches are manually operated by rotary shafts leading to the tower base.

From the circuit breaker tower, the lines are brought to the center point of the main bus structure, a distance of some 90 ft. and there dead-ended to the top cross member of the structure which is carried at a height of 64 ft. by extending the center post girders to that elevation. It will be noted that six bays have been provided in the 220-kv. bus structure, one bay being utilized for paralleling the bus structure and one each for Tiger Creek circuit No. 1, Tiger Creek circuit No. 2, and one for each of the transformer banks served by the two circuits. The center bay is a provision for the future transformer bank which will be installed at this station when the new Electra power house is completed. Bays are 46 ft. wide with a 15-ft. spacing between conductors.

Each of the two buses extends the entire 350-ft. length of the structure, one bus being on each side of the center tower. Bus conductors are 650,000-circ.mil concentric-lay copper cable supported on the cross frames with post type insulators at each bay. These insulators are made up of six 16-in.diameter, 14-in.-high units. Incoming and outgoing lines from the bus structure take off from the elevated portion previously described. Connections from these lines to the double bus are made through vertical-break selector switches mounted on small structural steel frames in the center of each bay.

Each single pole assembly of the selector switches consists of two single-pole air switches mounted on a common structural steel base, the base being supported on five insulator posts. Three poles of each selector switch,



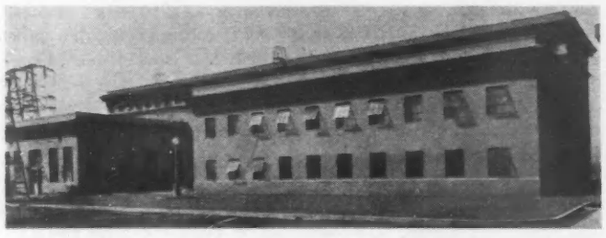
Section of 100-kv. bus structure; incoming power fed through two circuit breaker banks at right, take-off towers for outgoing lines on left

comprising one three-phase circuit, are actuated by a single manually operated control handle located at the bottom of the supporting column adjacent to the selector switch assembly. Flexibility and economy in switching apparatus are paramount advantages of this arrangement as the two incoming power circuits may be connected to either bus or the same bus, or, if desirable, the two buses may be paralleled by means of a circuit breaker and air selector switches in the end bay.

At present two transformer banks are installed between the 220-kv. bus structure and the 100-kv. bus structure; each bank can be connected to either or both buses. Circuits brought out from the 220-kv. bus structure are led to the primary of these transformers, which are of the single-phase auto-transformer type. Each transformer is rated at 18,000 kva. and converts the energy from 200,000 volts to 110,000 volts. An additional tertiary winding of 11,500 volts is brought out from the transformer to which is connected two synchronous condensers. Transformers are installed in two banks of three transformers each with one spare transformer arranged so that it can be readily exchanged with any unit which might have to be removed from service for inspection or repair. Cooling is accomplished by means of radiators equipped with the hood-type radiator air blast equipment, which provides an individual motor-driven blower for each radiator. This blower starts automatically when the temperature of the transformer reaches a predetermined point. To facilitate handling these units, which weigh approximately 200,000 lb. each, a permanent transformer house was constructed. This building is equipped with a traveling crane and all necessary tackle for untanking and inspecting the units.

The output of these transformers is delivered to the 110-kv. bus structure. In general design, this bus structure is the same as the 220-kv. arrangement. In its 1,200 ft. of length, positions for sixteen line circuits, six transformer bank circuits, two bus tie circuits, three bus sectionalizing switches, and one bus reactor are provided. The double bus arrangement is used and buses are mounted on a galvanized steel structure 50 ft. high. Tubular copper, 2 in. in diameter and of 640,000-circ.mil area, is used for the buses, which are mounted on post-type insulators. These insulators are composed of two 16-in.-diameter, 20-in.-high units. Selector switches are of the same general design used on the 220-kv. bus.

Station control is made possible through a switchboard and four synchronous condensers in this building; two condensers operate on 100-kv. system, two on 220-kv. lines from Mokelumne



Because of the heavy concentration of power it was considered advisable to divide the bus into two sections each controlling twelve circuits. Between each section three oil-immersed current limiting reactors are installed, each rated at 5,400 kva., single phase, 60 cycles, 110 kv. Reactance provided in this manner equals 60 ohms and the units will carry 300 amp. continuously with an overload capacity of 1,060 amp. for 3 seconds. Externally operated tap changers are provided to maintain voltage balance between the two sections of bus. These are the largest reactors ever built, and their installation divides Newark into essentially two stations, the new section comprising the 110-kv. bus, now fed from the Tiger Creek line, and the older section consisting of equipment which has been installed in the past to accommodate the increased energy from this station. The old section consists of an 100-kv. bus, and a 60-kv. bus fed from the 100-kv. structure. Three circuits take off from the 60-kv. bus, two going to San Francisco and one being connected to the transmission line from Electra power house. This latter line is interesting from the standpoint of power flow. Originally Electra power house was designed to furnish power to San Francisco but subsequent growth of load along the line consumed an increasing amount of the output of Electra power house and at the present time load conditions are such that power often flows from Newark toward the Electra generating station.

Another interesting feature of this line, which was one of the pioneer high-voltage installations in the world, is that it now terminates in the pioneer installation of 60-kv. cable on the Pacific Coast. As this line terminates at Newark substation on the opposite side from the 60-kv. bus structure, it was necessary either to build the line around the station and across several 110-kv. lines or to carry the power underground to the bus. This latter course was decided upon from both the engineering and economic standpoints. Three single-conductor cables are used, each cable consisting of a stranded copper conductor 500,000 circ.mil in area and insulated with a 48/64-in. layer of saturated wood pulp paper with metallized paper shields and a 9/64-in. commercially pure lead sheath covering. It is rated for 400 amp. at 60 kv. and each of the three cables is installed in an individual fiber duct for the 300-ft. run under the station. Terminals

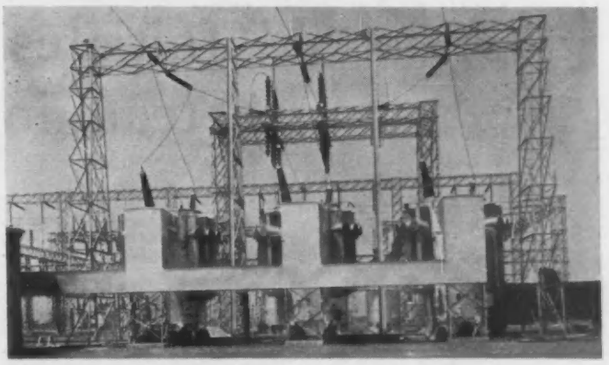
are of the oil-filled barrier type rated 110 kv. and are mounted on a steel framework which also serves as the terminal point for the overhead 60-kv. lines forming the circuit of which the cable installation is a part.

Enlargement of the control building at this station was necessary to take care of the increased capacity brought in by the Mokelumne power development. The original building housed the switchboard and two synchronous condensers which were connected into the 60-kv. system for power factor correction. These condensers were rated 12,500 kva. each and operated at 13.5 kv. Two additional condensers have been added, each condenser rated at 25,000 kva. and operating at 11.5 kv. They are connected in the Tiger Creek circuit through the 11.5 kv. tertiary winding on the auto-transformers stepping down the power received from those lines.

As the control building is located between the two 100-kv. bus structures some distance from the transformer supplying power to the condenser, it was deemed advisable to install the control apparatus close to the source of power supply, thereby eliminating several hundred feet of 11-kv. cable. Consequently a switch house was constructed between the two transformer banks in which is mounted an 11.5-kv. bus of the metal-enclosed type consisting of nine truck-type, 2,000-amp., 150-kv. oil circuit breakers and four compartments in which are mounted the motor-operated disconnecting switches. Underground lead-covered cable connections are made between the switching equipment and the condensers, using four 750,000-circ.mil, three-conductor cables. Each of the two new condensers is rated at 25,000 kva., 11.5 kv., 720 r.p.m. and is of the totally enclosed ventilated type equipped with surface air coolers. Each condenser has a direct-connected main and pilot exciter and one condenser is equipped with a direct-connected synchronous motor rated at 1,500 hp. for driving the condenser as a generator during line and relay tests. It is interesting to note that the condensers are provided with a fire protection manifold around each end of the air gap. Water will be used to extinguish such fires.

Switching requirements for the increased capacity of the substation necessitated the installation of a complete new switchboard. Unifying the existing and newly installed control equipment in the new switchboard room without disturbing the station's service was facilitated by the use of a control circuit terminal room located directly beneath the switchboard. The new switchboard is arranged in two sections corresponding to the arrangement of the station 110-kv. bus structure.

220-kv. bus structure with incoming circuit-breaker bank and terminal structure on the extreme right

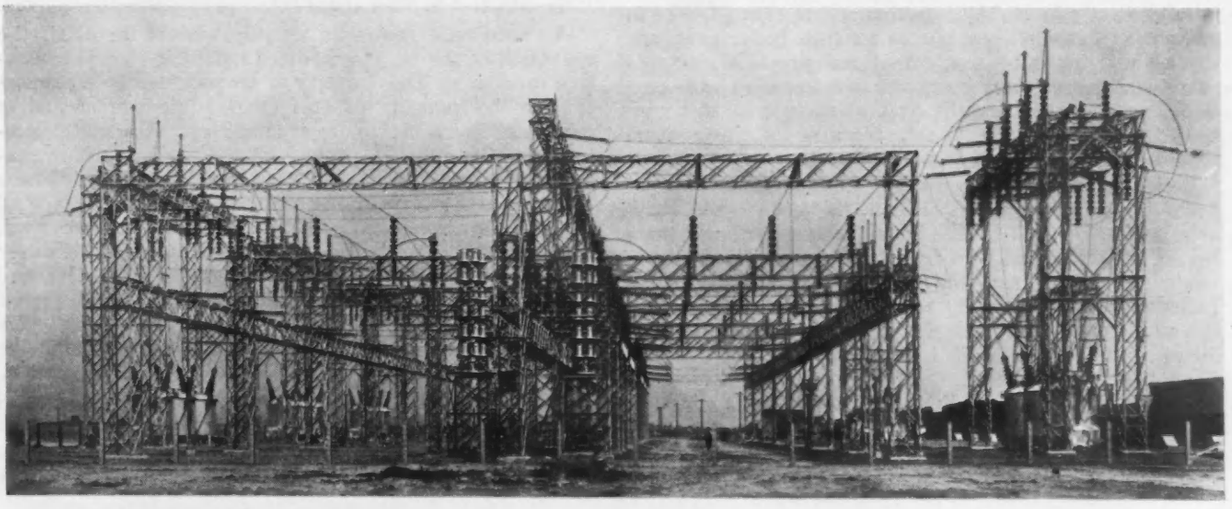


Auto transformer bank between 220- and 110-kv. buses. Tertiary winding brought through metal housing shown connects two synchronous condensers to system

Owing to the large number of circuits involved it was necessary to use a benchboard and two vertical boards, one for indicating instruments and a second for relays, in order to make the control equipment quickly accessible to the operator. To make the installation still more compact and reduce the over-all length of the switchboard, two circuits per panel were installed, one circuit being above the other, necessitating the use of 100-in. panels.

Panels are of ⅛-in. stretcher-leveled steel bolted to angle-iron construction. Upright angle supports for the panels are extended through a slot in the floor running the length of the benchboard and both vertical panels, through which switchboard leads pass into the terminal boxes of the control circuit terminal room. This feature of the construction greatly aided switchboard erection as panels could be wired complete at the factory with the connecting leads having an additional 4- or 5-ft. length below the switchboard so that they could be extended to the terminal boxes without splicing. The accessibility of control circuits made possible through this type of installation method permitted changeover of old control circuits and testing of all circuits without service interruption.

Communication by means of carrier current telephone equipment is installed at this station and will permit conversations between Tiger Creek power house and station "J" in Oakland, where a wire extension leads to the load dispatcher's office. Coupling condensers were installed on the 110- and 220-kv. buses and so connected that the dispatcher may communicate directly with Tiger Creek power house without assistance from the Newark operator.



Station "A" Initiates Use of High-Pressure Steam in the West

By W. C. McKay
Assistant Engineer, General Construction, Pacific Gas and Electric Co.

and C. E. Steinbeck
Assistant Engineer, Department of Steam Engineering, Pacific Gas and Electric Co.

Boiler Pressures of 1,400 lb. Are Used in the New Steam Station of the Pacific Gas and Electric Co. in San Francisco. One Hundred Thousand Kva. is Generated by Two Turbine-Generator Sets Recently Installed to Supply Increased Energy Requirements of the Bay Area

STATION "A," the final link in the three-year construction program completed by the Pacific Gas and Electric Co., has the distinction of being the first steam plant in the Western states to utilize operating economies derived from the use of 1,400-lb. boiler pressure. Here steam generating capacity, to the amount of 100,000 kva., will supplement the hydro-electric power to be generated in the plant on the Mokelumne River. Historically, station "A" typifies the advancement of steam-electric generation of power. The original installation was completed in 1901 and consisted of the most modern steam generating equipment available at that time. Original equipment included fifteen water-tube boilers operating under 200-lb. pressure and six vertical compound steam engines driving electric generators. Although it was first designed to burn coal, before the installation was completed oil had made its entry as a low-priced central station fuel for steam plants in California and the station was redesigned to utilize this fuel. Station capacity was increased periodically until, in 1910, the installation consisted of ten vertical reciprocating engines driving generators each rated at 1,500 kw. Compared to modern structures, the engine room was of immense size, being 425 ft. long and 57 ft. wide.

In 1910, the first turbo-generator, 12,000 kw., was installed. By 1919, four such sets had replaced all but two engine units, the plant capacity being 57,000 kw. with the two engines doing emergency service only. When additional steam capacity was needed, Station "A," in the center of the San Francisco industrial area, was logically selected as the seat. In place of two turbine units, the two engines and sixteen 200-lb. pressure boilers, the present installation of two 50,000-kva. turbo-generator sets and three 1,400-lb. boilers was substituted. The same floor space which produced 6,500 kw. in 1902 now supplies 100,000 kw.

As the steam plant has become a definite factor in the operation of Western utility systems, the engineers of the Pacific Gas and Electric Co. outlined plans for the rebuilding of station "A" to accommodate four 50,000-kw. generating units using steam at 1,400-lb. boiler pressure, the highest pressure now considered practical for this purpose. Two of these units are now installed and operating, and, as they are the first of their type to be installed on the Pacific Coast, features of installation should be of interest to Western engineers.

Boiler equipment necessary to supply steam at 1,400-lb. pressure was installed in the space made available by the removal of the boiler units previously mentioned. A structural steel framework was erected within the boiler room to carry the new boiler installation. Three Babcock & Wilcox boilers were installed. They are of the single-pass type, each designed to evaporate 500,000 lb. of water per hour at 1,400 lb. per sq.-in. pressure. Each boiler is equipped with a superheater which delivers steam at 750 deg. F Each boiler also is equipped on all four sides with a Bailey water-cooled furnace wall. Boiler drums are 60 in. outside diameter with 4-in. thick walls and are single forgings 51 ft. long weighing 70 tons. Drums are supported to the structural frame with 5-in.-diameter U-bolts at each end. Boilers and turbo-generator sets operate as units, one boiler being sufficient to supply steam requirements for a 50,000-kw. turbine. The third boiler acts as a spare: As the turbines are compound units consisting of a high-pressure and a low-pressure unit, and as the steam from the high-pressure unit is reheated before passing into the low-pressure unit, two of the boilers are equipped with reheaters. The third unit has no reheater. Reheating is accomplished through the use of both a live steam and a flue gas reheater in each of the two boilers so equipped. In addition all boilers are equipped with economizers and air preheaters. Each boiler furnace is 42 ft. wide, 16 ft. deep, and 21 ft. high, giving a total furnace volume of 14,400 cu.ft. Reheat boilers are equipped with 26 and the spare boiler with 22 combination gas and oil burners designed so that they may be readily changed from one fuel to the other. Under full load conditions each of the reheat boilers will burn 562,000 cu.ft. of natural gas per hour.

One forced draft and one induced draft fan is provided for each boiler. The forced draft fan will deliver 680,000 lb. of air per hour at 15-in. water pressure. It is equipped with two motors, one rated 150 hp. for low-speed operation and one rated 600 hp. for high-speed operation. The induced draft fan will deliver 760,000 lb. of flue gas per hour at a 15-in. water vacuum. This fan is also equipped with the two-motor drive, one motor being rated 350 hp. and the other 1,100 hp. Air supply delivered by the forced draft fan will be preheated to 470 deg. F.

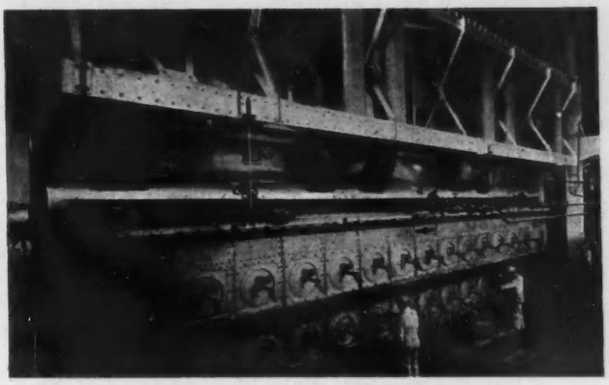
The induced draft fan sucks the gases of combustion over the superheater, then through the flue gas reheater, the economizer, and finally through the air preheater after which it is discharged into the breeching and stack.

As automatic combustion equipment is installed, the operation of the fan is controlled indirectly from combustion conditions. The quantity of air provided is in proportion to the quantity of fuel burned and combustion is maintained at a maximum of efficiency. Automatic combustion is accomplished through the use of Bailey combustion control. Located between No. 1 and No. 2 boilers is the control panel for the combustion system. Here all controls for normal firing operations are assembled. Each boiler control panel includes a steam flow indicator, water flow indicator, multipoint draft gages, a fuel valve and various indicators such as position pointers of forced and induced draft vanes and others. In addition, a selector switch permits various operating conditions ranging from complete manual control to full automatic.

In this system of automatic combustion control, a relation between fuel flow and air flow is maintained. Meters installed in the first pass of the boiler and the last pass, which in this case is the air preheater, operate on a

pressure differential principle similar to an orifice or venturi meter. As variations in steam pressure control the fuel flow into the boiler, a change in velocity of the flue gases, in turn dependent on the air flow, acts through the meters to change the volume of air. In a combustion test made at the installation of the equipment, the air flow for the most efficient combustion is calibrated over the entire load range of the generating unit and the metering system is set to correspond to the calibration thus obtained. Consequently, subsequent operating conditions will effect the balance maintained in the control equipment so as to supply the exact amount of air necessary for efficient combustion.

Feed water is controlled by the recently developed Bailey Selsyn hydraulic control. This system operates on the theory that steam withdrawn from the boiler should be immediately replaced with an equal amount of feed water. This installation is the second in the United States and controls the feed water in the following manner: A mechanical linkage between the steam flow meter, the water flow meter and the water level indicator



Boiler front showing the 26 natural gas burners on each unit

is connected with a pilot valve. When steam leaving the boiler is the same as the amount of water entering the boiler and the water level in the drum remains constant the mechanical system remains in balance. A change in any of these three conditions is reflected in the water level indicator which, through an electrical contactor, changes the pilot valve in the direction which will restore the balance. The pilot valve, being too small to exert sufficient force to operate an indicator of any size, is supplemented by an hydraulic torque amplifier which moves a Selsyn generator corresponding to the pilot valve indication. The motion of the "sending" Selsyn is transmitted to a "receiving" Selsyn motor mounted on the control valve in the feed water pipe. This last mentioned valve consits of a Selsyn motor which acts as the pilot for a much larger motor which operates the valve itself through a geared mechanism. In high-pressure installations, such as the one under consideration where the feed water pressure is at 1,600-lb. two valves are used in series to reduce the pressure drop across each valve.

Control of the forced and induced draft fans, which is incorporated in the combustion control previously described, consists of a combined motor and vane operating mechanism. Motors driving the fans are of the constant speed squirrel cage type and draft is varied by controlling the vanes over the intake to the fan. In the control mechanism for these vanes is mounted a continuously running motor which drives the center plate of a solenoid operated double-action clutch mechanism. The solenoid is energized in either direction as may be determined by the automatic combustion equipment, so that either one side or the other of the clutch contacts with the rotating center plate causing movement of the vanes in the corresponding direction. When maximum vane movement has occurred with the slow-speed motor, a set of high-speed cams engage the clutch mechanism to close the vanes again at a rapid rate and at the same time the slow-speed motor is cut out and the high-speed motor connected to the fan. The vane movement then operates as before. Motors for the induced and forced draft fans are fed from an enclosed 2.3-kv. bus and controlled by a switchboard, both mounted in the fan room.

Main steam piping is entirely supported on a system of counter-weights. Stresses arising from expansions in the pipe are thereby eliminated as the entire system of piping is free to move into the position of least strain. There are no fixed points in the high-pressure piping system between the boiler and turbine. The steam pipe joints used in this installation are of the Sarlun type, being made by rolling an offset on the end of the pipe so that the latter is at right angles to the main section. This offset is machined on its face so that it fits flush against the next pipe which is similarly constructed. A flange, whose inner surface is machined to the same radius as the offset, is fitted over the offset and then bolted with through-bolts to the flange on the next pipe. The lips of the ends of the pipes exposed between the flanges are welded to complete the seal required for the high pressures to which the joint will be subjected.

Two General Electric generating units of the vertical compound turbine type are installed. In reality each generating unit consists of two turbo-generating sets, the high-pressure turbine and generator being mounted on the generator of the low-pressure machine. The high-pressure turbine operates at a throttle pressure of 1,250 lb. per sq.in. steam pressure, 750 deg. F. total temperature, and delivers 12,500 kw. at 3,600 r.p.m. The low-pressure turbine operates at a maximum pressure of 400 lb. per sq.in., 750 deg. F. total temperature, and is rated for a capacity of 37,500 kw. The exhaust from the high-pressure turbine unit is reheated in the boiler to 750 deg. F. at its exhaust pressure of 400 lb. per sq.in. and then delivered to the low-pressure unit. Each low-pressure unit discharges into a condenser having a capacity of 34,000 sq.ft. of condensing surface. Each condenser requires 37,500 gal. of water per minute when the unit is operating at full load. Condensers are constructed with a divided water box so that one-half of the condenser can be operated while the other half is opened up for inspection or repair. Construction of the tubes and headers of the condensers embodies the most modern design. Tubes are expanded at each end into a rigid tube sheet, the expansion in the tube itself being provided for by giving each tube a slight expansion bend. As this construction of the tube and the tube sheet does not require the insertion of packing between the two, condenser operation is more satisfactory, most condenser troubles being caused by leaky packing. Condensate pumps are located directly below the condenser. The low-pressure turbines are bled at the tenth and fourteenth stages to supply steam for feed water heating.

At the high pressure used in this plant, the pumping of feed water into the boilers becomes quite a problem. It requires 1,600 hp. to pump the requisite amount of water into each boiler at full load. The pumping of the feed water is accomplished in two steps. A primary pump, driven by an electric motor, will pump the water through three feed water heaters at a pressure of 600 lb. per sq.in. At this point, the secondary feed pump, which is driven by two auxiliary steam turbines, will take the water at 600-lb. pressure and pump it through the economizer into the boiler. One of the turbines driving the auxiliary pump takes steam from the cross-

over pipe between the high- and low-pressure main units and exhausts into one of the feed water heaters. The other turbine takes steam from an auxiliary source or direct from the boiler through a reducing valve and will supplement the first turbine when steam obtained from the cross-over pipe is insufficient to produce the power necessary to pump against boiler pressure. It is evident that the feed pump turbines are infinitely associated with the steam extraction, feed boiler heater system.

Reference to Fig. 1 will show the essential features of the plant in diagrammatic form as well as the steam flow through the system. In the boiler, steam is generated at a pressure of 1,400 lb. and a temperature of 580 deg. F. After passing through the superheater where its temperature is raised to 750 deg. F. it passes into the high-pressure turbine where the energy absorbed in generating 12,500 kw. reduces its pressure to 311 lb. and its temperature to 470 deg. F. The high-pressure turbine exhausts directly into a steam line feeding back to the boiler where the steam passes through the flue gas reheater and then into the live steam reheater, which process raises its temperature to 750 deg. F. At this latter pressure the steam enters the low-pressure turbine unit, and, although bleeding is provided as hereafter described, the main portion of the steam passes through the low-pressure turbine unit generating 37,500 kw. and then is exhausted into the condenser. Condensate at a temperature of 86 deg. is then pumped through the feed water heating system which consists of an evaporator, a deaerating heater and four live steam heaters.

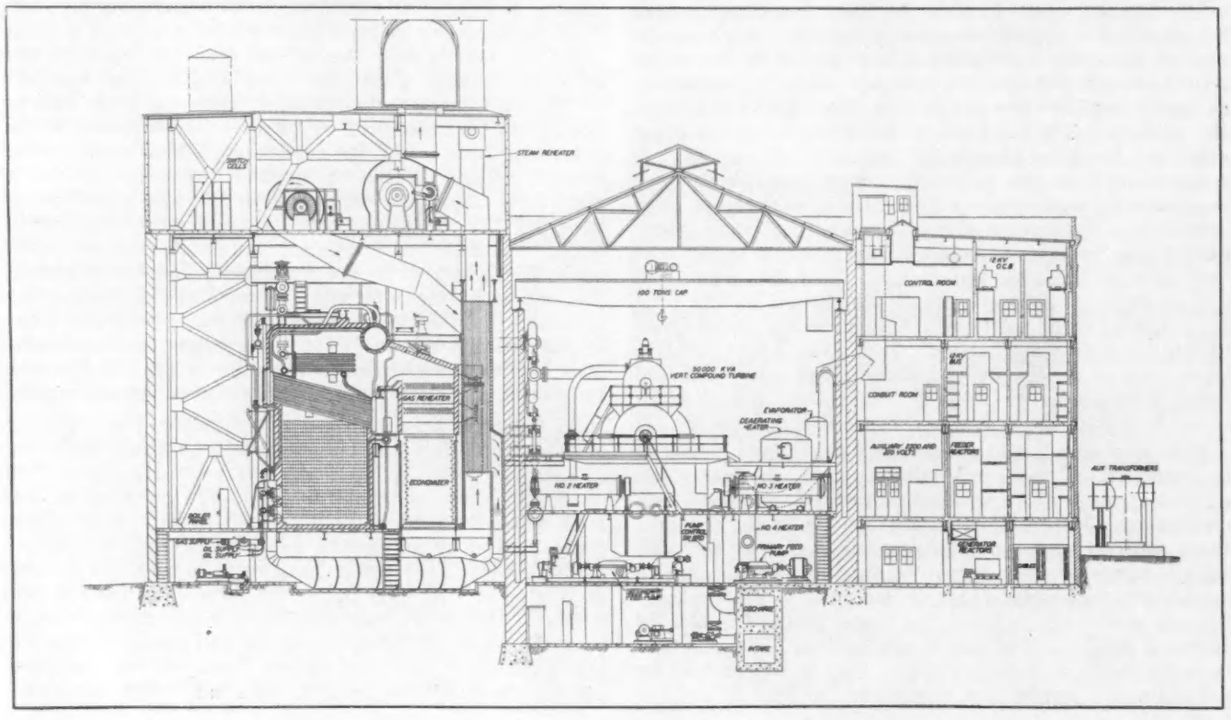
The first heater through which the condensate is pumped is heated directly by steam bled from the fourteenth stage of the low-pressure turbine. Steam bled from the tenth stage of that unit is utilized for heating in the evaporators, the deaerating heater and one of the remaining live steam heaters. Of the two remaining feed water heaters, one is fed from the return line of the high-pressure turbine and one is fed from the exhaust of the secondary turbine-driven feed water pump, which turbine receives its energy from the above mentioned cross-over pipe conveying the high-pressure turbine exhaust back to the boiler for reheating for use in the low-pressure unit. Steam bled from the low-pressure unit under full load conditions is approximately 12 per cent of the input to the turbine.

In high-pressure systems great care had to be exercised in maintaining the purity of feed water. This is an essential feature in any plant operating at very high capacities, as boilers can be forced efficiently only if they are entirely free from scale. To this end, the new installation was supplied with pure distilled water and subsequent make-up is also distilled water obtained through the use of an evaporator heated by utilizing steam bled from the low-pressure turbine as described. Make-up water as well as feed water after it has passed through the first heater then enters an open type heater for deaeration. The deaerating of the feed water is essential to guard against corrosion in the economizers and boilers and is accomplished by heating the water to a point where dissolved air is driven off.

Condensate, in following its course back to the boiler passes first through a heater where it is raised to a temperature of 170 deg., then into the deaerating heater from which it emerges at a temperature of 222 deg. and enters the primary feed water pump. This pump raises its pressure to 600 lb. and forces water through three additional heaters where its temperature is successively raised to 258 deg., 348 deg., and 407 deg. F. It is then picked up by the secondary feed water pump and forced through the economizer into the boiler. In the economizer, the water is raised to a temperature of 525 deg. F. by heat absorbed from the flue gases.

On a total output of 50,000 kw. per unit the water rate in pounds per kw.-hr. at the throttle of the turbine is 8.43 lb. Condenser water rate for this load is 5.98 lb. per kw.-hr. The economy of the high-pressure and heat-balance design of this station is attested by the fact that a kilowatt-hour is produced from 9,170 B.t.u. supplied to the turbines. When allowance is made for boiler effi-

Fig. 1—Cross-section through Station "A." All modern aids to efficient combustion and power generation are engineered into a compact and efficient installation



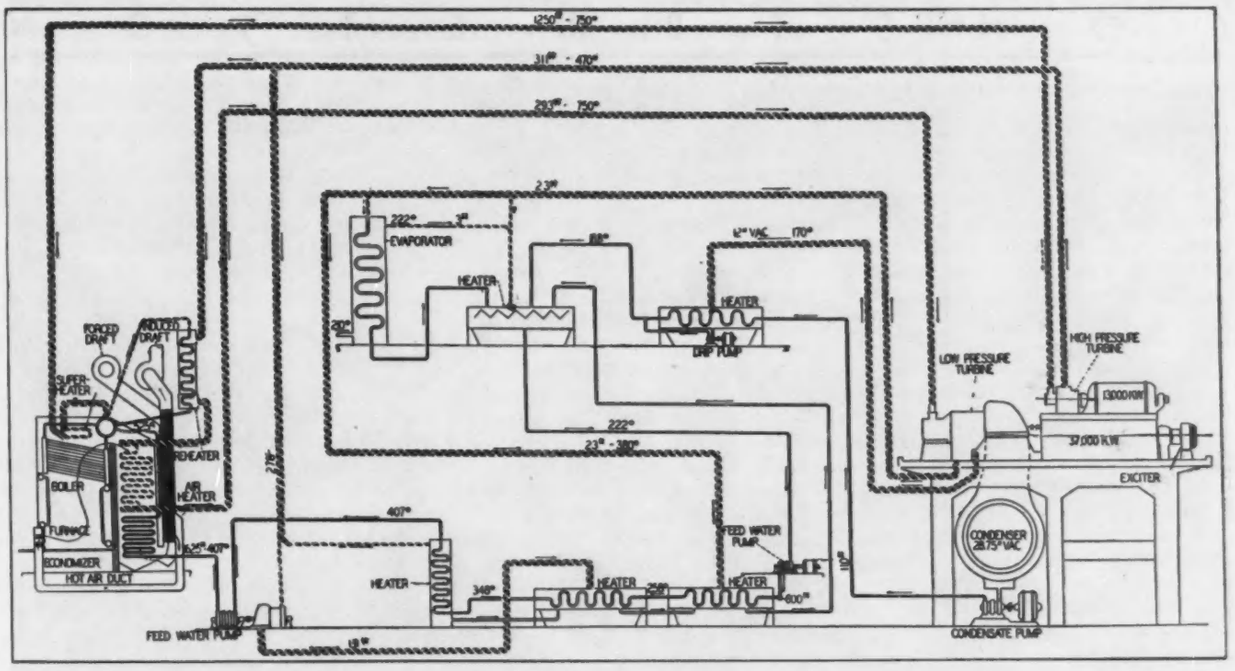


Fig. 2—Steam flow diagram showing the arrangement of equipment to secure an efficient heat balance

ciency and auxiliary power, the fuel consumption is at the rate of about 12,000 B.t.u. per net kilowatt-hour.

In supplying the tremendous amount of circulating water necessary for condenser cooling, a water system was designed and constructed for 350 cu.ft. of water per second, the ultimate capacity of the station. Cooling water is taken from San Francisco Bay into a pump sump near the pumping station. The essential equipment in the pumping station consists of two 55,000-g.p.m. and one 40,000-g.p.m. motor-driven centrifugal pumps. Ultimately another 65,000-g.p.m. pump will be added. The larger pumps are driven by 1,250-hp. motors and the smaller by a 700-hp. motor, power being supplied by truck-type oil circuit breakers connected to the low-voltage bus. At present, a 60-in.-diameter and a 30-in.-diameter cast-iron pipe supply the water requirements from the pump station to the condensers, but eventually the smaller will be replaced by a 60-in. pipe. Water conduits in the station are laid one above the other, the incoming water passing through the lower pipe and being distributed to the different condensers, and the discharge flowing through the other conduit back into the bay.

With the addition of the two new generating units, the electrical installation of the plant necessarily had to be revised and enlarged to accommodate the increased power being made available.

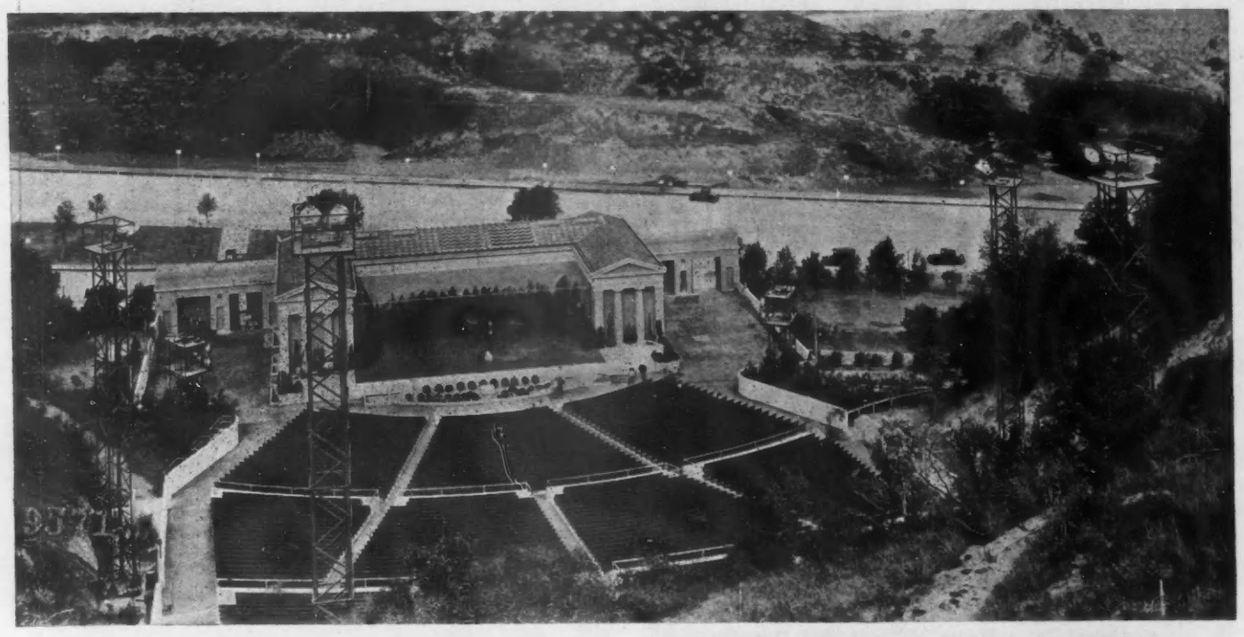
As the two generators of each unit operate in parallel at 11-kv., they must be tied together on a common bus before being synchronized with the system. This is readily accomplished as the high-pressure unit is started and connected through circuit breakers to the low-pressure unit which is motored up to speed by the high-pressure generator. The two machines are then synchronized to the 11-kv. bus as a unit, field control being operated from the switch board although motor-operated field rheostats are mounted in the turbine room above the turbine control board.

Power from this station flows through 25 circuits feeding directly from the 11-kv. main bus; in addition four circuits feed into transformer banks which supply station power as well as several nearby industrial plants. To accommodate this arrangement a new building was constructed adjacent to the main power house, in which building the 11-kv. bus is mounted. The double bus construction again is adhered to in this installation, outgoing circuits being fed from either bus through cell-mounted oil circuit breakers. This requires the use of 64 oil circuit breakers for the outgoing circuits, 10 oil circuit breakers for bus ties between the five sections of 11-kv. bus, and eight oil circuit breakers, four rated 4,000 amp. each, to tie the new generating units to the bus and four to tie the existing 15,000-kva. generating units to the bus.

All controls for these circuits are brought into the switchboard room through a control terminal room located directly below the switchboard. This terminal control room is a feature which facilitates segregation of the highly complex circuits of a modern power plant as well as simplifies construction operations. Regarding this latter point, control conduits can be installed so that they terminate in this room, and by providing a number of spare conduits, changes in design can be made with a minimum of expense and delay after construction operations are in progress.

In appearance the room may be likened to a telephone exchange, control circuits being brought to terminal boards from which connections to switchboard instruments and control switches are taken off. Terminal boards are housed in pipe-mounted metal enclosing cases arranged to correspond with the circuits from various sections of the plant.

Station operation is controlled from the switchboard room located directly above the conduit terminal room. The switchboard is of the benchboard type with relays and instruments for the generating units being mounted on vertical panels to its immediate rear. On the opposite side of the room a vertical switchboard mounts the control apparatus, meters and instruments for outgoing circuits from this plant. Excellent illumination is provided through a diffusing glass skylight and by means of flush-mounted Holophane lighting units in the ceiling.



A highly successful night-opera season is under way at this amphitheater in Griffith Park, Los Angeles. Lighting effects from the six towers aid in creating an illusion of reality rather than fiction

Going the Greeks One Better

Although It Follows Closely the Classical Lines of the Famous Athenian Arena, Los Angeles' Greek Theater Possesses a Harmonious Lighting Scheme, Thus Adding Utility to Beauty

By O. W. HOLDEN
Junior Electrical Engineer Department of Water and Power, Los Angeles

ANCIENT Greek theaters had no lighting problem, for the structures were used only in the daytime. Los Angeles' Griffith Park Greek Theater, because it follows the general classical lines of its prototype, possesses no inherent provision in its architectural design for the accommodation of lighting equipment, but a harmonious, yet adequate, illumination system has been perfected to afford night utility. And so electricity helps to out-Greek the Greeks.

In general, the structure consists of an amphitheater approximately 160 x 230 ft., seating 4,400 persons, and an open stage 48 ft. deep, 110 ft. wide in front and 70 ft. wide between wings. The stage is backed by 20-ft. walls which form a part of the building which houses scenery rooms, offices, star dressing rooms and organ room. Below the stage are commodious quarters for men's and women's dressing rooms, costume rooms, sewing and dye rooms, emergency hospital, garage, public lavatories, dining room and kitchen. It was the intent of the builders to erect a plant complete in every detail for the accommodation of any sort of entertainment ordinarily produced on a stage.

Two lighting problems were involved: the devising of a means for supporting the equipment with the least detraction from the beauty of the structure, and the production of adequate illumination on the stage and amphitheater with minimum glare to both the seated and incoming audience.

Constructed on the side of a hill, the last row of seats is nearly 100 ft. above the front row. This area was lighted simply by erecting four 70-ft. fabricated steel towers outside the walls of the amphitheater, two at the rear and one on each side, and mounting on each tower two 24-in., 1,000-watt floodlights with bases tilted at 45 deg. to permit the projectors to extend beyond the platform edge so that when directed downward light is not spilled on the platform. Hammered reflectors and clear lenses are used except on the two projectors covering the center portion where diffusing lenses are necessary because of the shorter throw.

The intensity of illumination on a printed program as ordinarly held by a spectator in any part of the amphitheater is 1.5 foot-candles or better.

So unlike the conventional indoor theater stage is this that entirely different lighting treatment was necessary. No proscenium, borders, or tormenters afford masking of lighting equipment. It was decided that a mass of light from the front and at some elevation above the stage would produce satisfactory lighting for simple settings, but that ample facilities should also be provided for any degree of elaboration that might possibly be required.

The principal source of stage lighting is from steel towers placed at the sides beyond the amphitheater walls and nearly even with the front row of seats. The towers support permanent equipment and afford accommodations for additional portable apparatus. The permanent equipment consists of floodlighting projectors arranged in two tiers, each being composed of two 1,500-watt and one 1,000-watt lights—twelve in all. The elevation of the lamp center of the lower tier is 17½ ft. above stage level

and the distance to the stage center is nearly 100 ft. Each tier is adjusted for light distribution over the entire stage, and wiring connections are such that either may be used independently for normal intensity or in support if higher intensities are required. Further, this wiring arrangement permits separate control of each tier when the projectors are screened in different colors. All projectors are equipped with louvres to prevent stray light annoying the seated spectators, and with holders for the use of color screens.

To accommodate portable equipment such as spots or special color projectors, the tops of the towers have been designed as platforms, 22½ ft. above stage level. Six section pockets, in weatherproof cast-metal boxes, serve each tower. Corresponding pocket receptacles on the two towers are connected in parallel to the same switch and dimmer, a feature which permits simultaneous control of both sides and better loading of the dimmers.

At the center of one of the transverse aisles, a six-section pocket has been installed in case it is desired to set up portable projecting equipment at that point.

Footlights, provided for the 70-ft. portion of the stage between wings, are constructed in 6-ft. sheet metal sections so that they may be readily placed in the footlight trough and plugged in for service or removed and stored between productions. Each section contains twelve 150-watt lamps alternately wired for three-color control. The reflectors are chromium plated and each is furnished with a glass roundel of the proper color. The center 36 ft. of footlighting may be controlled with or independently of the remaining footlights, in case only the center portion of the stage is required for some performance. Six receptacles on individual circuits, for attaching baby spots, are distributed through the footlight trench.

Floodlights on the stage lighting towers and the footlights comprise the only permanent stage lighting equipment installed. Additional light must be obtained from portable equipment for which an abundance of stage pockets have been provided, both on the stage and in the wings. The pockets on the stage are located in the walls near the floor and are equipped with bronze covers and locks. Pockets are three- and six-section for three-color control and all pocket circuits are designed for 30 amp. Pocket boxes have been installed just below the eaves to be wired and equipped if the theater ever needs overhead stage lighting.

Lighting controls on the stage switchboard are of two classes: (1) circuits equipped with manually operated dimmers, connecting with the three-color buses and arranged for master switching and master dimming, and (2) miscellaneous circuits both directly and remotely controlled, equipped with toggle and push button switches on the master panel.

Occupying the entire board with the exception of the master panel, the first class of controls consists of three horizontal rows of switches and dimmers connecting with buses designated white, red and blue. The buses extend the entire length of the board and are in duplicate for each color, the upper position of the switch connecting to the "constant" bus and the lower to the "color master" bus.

The supply to each constant bus and each color master bus is switched by six magnetically held contactors mounted on the main switchboard in the basement. These contactors are remotely controlled in various combinations by six 2-pole, 60-amp. master switches on the stage switchboard. Thus each of the three-color master switches may control its contactor individually or may be thrown to transfer control to a fourth or grand master switch. A constant master switch is provided to control the contactors on the three constant buses. A "black-out" switch controls all six contactors mentioned, together with certain of the miscellaneous circuits, so that when this switch is opened, the operator is assured the stage will be absolutely dark. Pilot lamps with colored lenses indicate when the corresponding buses are energized.

Dimmer control is of the individual cross control type; each dimmer handle may be interlocked with either of two color master handles, permitting one group of that color to be dimmed while another is brightened. The "end foots," which may be controlled independently of the "center foots," is an exception, the dimmer handle being constructed so as to interlock either with one of the color master dimmer handles or with the "center foots" dimmer. The color master dimmer handles in turn interlock with two grand master dimmer levers so that any group of circuits on the entire board may be dimmed while another is brightened.

All pocket circuits are equipped with double rated dimmers which will carry 3,000 watts maximum, but will dim sufficiently on half-load.

Amphitheater lights are switched and dimmed from the master panel by a toggle switch and three push buttons. The toggle switch controls a contactor and the buttons control a motor-operated dimmer in the basement. When started, the dimmer will move up or down and travel to its limit unless the stop button is pressed. The normal time of travel is 10 seconds. Two pilot lights indicate when the dimmer is in the limit positions, and whether bright or dim.

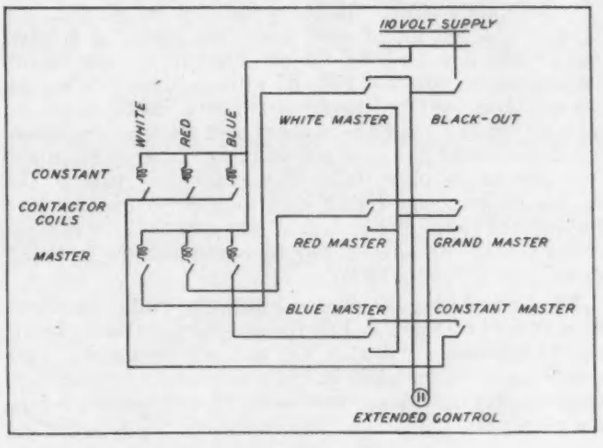
The switchboard is 14 ft. long and consists of 31 switch and dimmer positions for each color, in addition to the master panel. Of these, eleven positions are for future possibilities. The master panel carries the operator's telephones, and a group of call buttons, together with indicating lamps for return call indication.

Operated by a ¾-hp. motor, a draw curtain may be controlled from the stage switchboard or from either side of the stage.

All parts of the building are connected by a complete intercommunicating telephone system. Another system connects only the ticket booths and the manager's office, and a third, used only for directing lighting effects, runs from the stage switchboard to the tower platforms and to two points in the amphitheater from where one may direct the lighting and watch the effects, a provision quite necessary as the switchboard operator has a very limited view of the stage.

Near the stage switchboard is a microphone connecting to loudspeakers in the dressing rooms, halls and offices for convenience in making announcements to the staff and cast, or in paging individuals.

Master control wiring diagram



At the rear of the amphitheater is a radio room equipped for broadcasting, by remote control, programs from the stage and from the future organ. A loudspeaker is concealed in each gable of the stage wings which may be used for amplification. The theater is amply provided with cables and convenient terminal boxes for attaching microphones.

Electrical energy is supplied at 4,600 volts, entering underground to a vault within the structure. A transformer bank, consisting of one 7½-kva. and one 37½-kva. transformer, in open delta, is in constant service to furnish general building lighting and power. Another bank of two 75-kva. transformers supplies light for performances and is switched by a motor-operated oil circuit breaker in the transformer vault, controlled by a lock switch on the stage switchboard.

That the beauty of the theater was enhanced by the lighting was demonstrated on the opening night when the audience spontaneously applauded the lighting effects even before the curtain was raised.

▼ ▼ ▼

Re-Inspection Must Be Sold

Abundance of Work Awaits Contractors If Need for Modernizing Overloaded Wiring Can Be Sold the Property Owner

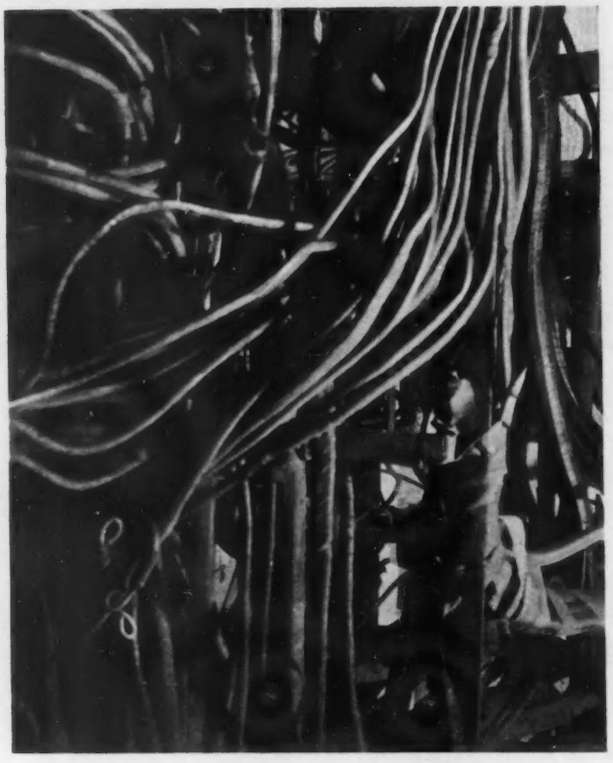
DIPLOMATS, better even than those who must wrestle with the involved problems of international relations, the inspectors who are assigned to re-inspection work must be. This has been the experience of A. E. Johnstone, past president of the Southwestern Section, I.A.E.I., city electrician of San Diego, whose re-inspection activity has resulted in much effective reconditioning of outworn wiring systems in that city. His activity, moreover, has resulted in no more recoil than an occasional explosive outburst and a rarer threat of his position, natural under any circumstances. In all cases, however, he has been able to convince the aroused accuser of his sincerity and of the necessity for the action taken by the electrical department in condemning the wiring.

Far from being a mere matter of blunt regulation and law enforcement, Mr. Johnstone has found re-inspection requires one of the most delicate selling jobs in the industry. Authority to condemn wiring, which many contractors seem to feel is all that is necessary, is a club that must be padded generously with tact, diplomacy, knowledge, both of the engineering reasons for the action to be taken and of human nature, as well as of the way to sell the idea to the property owner. Notice to make changes in the wiring system to bring it into conformity with city regulations must be translated into terms of property owners' own interests. Sometimes it must be accompanied by an appreciation of the financial condition of the owner and his ability to pay for the needed changes. Ofttimes it is necessary to arrange a budget system of successive repairs.

Rewiring on a Budget System

"One case in particular," said Mr. Johnstone, "will serve as an illustration of how fair we try to be in all cases. We have one man who specializes in this work, because of his tact and understanding. Yet many of the owners demand that I come to see them myself, hoping to be relieved of the condemnation notice. I always go when necessary, but I have yet to find a case wherein I could not back up the inspector.

"In this case, it was an industrial plant where a good deal of water was used in the preparation of the product. The works were on the ground itself, and this ground was nearly always wet. I found a dilapidated set of open knife switches, old type starters, and a tangled mass of open wiring. The equipment was in condition to break down almost any time or any place.



This maze, in an auditorium where thousands weekly hear concerts, attend religious services, would have stumped Alexander the Great

"The manager told me that it was simply impossible to repair the wiring. Business had been so bad that the cost of the job would shut down the plant. I pointed out to him first that he did not want to kill any of his employees or run the risk of killing himself when he turned on a switch; that the cost of a death would be greater by far than the wiring, and that on the other hand danger of fire starting was so great that he might lose the entire plant from this cause, and that if the insurance company found that negligence on his part had caused either fire or loss of life, and the city records showed that the wiring had been condemned, it would prove a very costly affair.

"We talked over the financial difficulty and determined on a budget of $50 a month for several months, as being within his means. A plan was laid out, comprising successive steps to be taken in the repair and rewiring each month. His contractor was called in and cooperated in the plan.

"The very first thing I asked was that a dry insulated platform be put in temporarily at the switch board in order to give his men a 'break' for safety. Next enclosed, externally operated switches were to replace the open knife switches. Then the open wiring was to be put in conduit, and so on through to the particular requirements of each machine.

"Finally I pointed out to him that prevention was better than cure. It would be far easier, I showed him, to have all alterations and additions made to his wiring in the future by a qualified contractor than to allow his installation to go 'haywire' on him and cause him to face a big revamp job in a lump.

"We parted friends, determined to do the right thing because it was right, safe, efficient and humane, rather than because it was the law. Some two months later the manager called me in to see the completed job. Once started on the revamping he was so well satisfied with the results that he had been impatient to have it all done. He was proud of the new layout and wanted me to know it."

With apartment houses, flats and hotels the problems are multiplied. The hazard to life and property is not so apparent and the business appreciation of a well installed, well engineered job is seldom present. Moreover, conditions are usually worse in such places than in a commercial or industrial establishment.

An example of the effect of changing occupancy and how it brings excessive demands on the wiring is contained in the case of one place mentioned by Mr. Johnstone. Two houses, formerly large residences, adjacent to each other, had been engulfed by the business district. They had been partially revamped to accommodate a doctor's office, a beauty parlor, a chiropractor and to convert the upper floors into flats. The entire arrangement was served by a pair of No. 12 wires. It had five meters installed, one for each house, one for a four-room separate flat, one for the basement, and another for a building front arrangement which joined the two houses.

The load on this pair of wires, besides lighting, included a 20-amp. permanent wave machine, a 12-amp. hair dryer and other small devices in the beauty parlor, all on one circuit connected to a pair of feeders which also supplied electrical devices in the doctor's office, including a 2,000-watt vapor bath (the doctor himself had taken the cover off of an outlet box and tapped to a joint to supply his appliances), plus some electrical devices which the chiropractor had. The latter had run extensions with armored cable, lamp cord and open wiring through a gas pipe in places. No joints were soldered or taped and all lamp cords were tacked to the walls or baseboards. Naturally the voltage was poor and all of the appliances were giving unsatisfactory service.

Convincing the owner of such types of property of the need for rewiring is no simple matter. As long as the lights "burn" he believes his obligation to his tenants is met.

Education of Apartment Owners

The procedure in dealing with this type of problem has been tabulated by Mr. Johnstone as follows:

1. The inspector introduces himself to the owner or manager, explains that the city electrical ordinance requires a re-inspection of electric wiring in buildings every two years to insure that it is in a safe operating condition.

2. He sells the idea to the owner that he can maintain wiring and equipment in a safe condition at little expense or effort if he is vigilant, and that it is desirable to do so.

3. Instructs him in proper fuse protection of service feeders and branch circuits.

4. Asks him to eliminate cord wiring, bell and telephone wires used for extensions.

5. Asks him to keep open knob and tube wiring free from contact with other objects, wood, stored materials, etc.

6. Shows the need for guarding the operator at an open switchboard with a rubber matt on the floor and maintaining a light over the board so that it can be clearly seen, or else installing externally operated switches.

7. Instructs him on the necessity for grounding all equipment.

8. Has him label all switches so as to identify the equipment each controls.

9. Shows him why all lights controlled with brass key or chain pull sockets around grounded surfaces, such as in kitchens, over sinks, over stoves, in bathrooms around plumbing or over cement floors in basements or laundries, should and must be corrected by the installation of insulated sockets.

10. Open cutouts and switches, he is brought to feel, should be changed, where necessary, to externally operated switches of the dead front type, and open bus wiring enclosed where subject to mechanical injury.

11. Advises the protection of wiring by adding knobs, tubes, soldering joints and proper taping, using loom in required places; removing unsafe wiring and seeing that objects are removed from near the wires in attics, basements or open warehouses.

12. Requires the installing of dead front receptacles in place of the old type screw socket receptacles so that children cannot get their hands into them and get burned.

13. Informs the owner that the electrical ordinance requires that new or changed outlets be installed by a licensed contractor and that they be inspected and approved by the city inspector.

14. Finally, invites the manager or owner to call the department of electricity for any advice needed and to call the power company to locate trouble.

Although this one inspector assigned to the work can only give part of his time to the work, the department is ably assisted by the fire department in its continual survey of the city, and by the power company trouble men who find overloaded or poor wiring as the cause for blown or coppered fuses.

Further education of the public in the need for proper wiring is being done by Mr. Johnstone by means of talks before civic clubs, women's organizations and schools. In these talks Mr. Johnstone tells the purpose of fuses, tells how to replace them, describes how wiring is improving and how the increased use of appliances in homes today requires greater facilities to serve those appliances. He describes how cords should be used, what kinds are best for various appliances, and how they should be replaced when worn. He cautions as to the use of heaters in bathrooms, and against the use of lighting or any other appliance while in the bathtub. Actual cases always lend emphasis to the talk.

Undoubtedly this quiet, constructive work has resulted in much work for electrical contractors. Yet it is not spectacular, and it cannot be looked upon as the great saving bonanza for contractors that it may appear to be. Logically, re-inspection should provide a sound, even growth of business in a growing community. But it must be sold. Even the electrical inspector has to sell the idea, despite the fact that presumably the law is all that is necessary.

Laying Cable With a Plow

For Airports, Tracks, Golf Courses and Large Areas This Fast Means of Laying Underground Systems Speeds Contract

Above—Ahead of the plow goes the truck bearing the spools of special trench cable, paying it out as the plow, shown below, buries it in the ground

Right—The plow itself, drawn by a tractor, is an adaptation of the road scraping machine, made and patented by the General Cable Corp., and rented to the contractor. By means of hand wheels mounted above, the cutting wheel and plow mechanism can be lowered to desired depth. The cable feeds over a sheave into a conduit and is laid at the bottom of the trench made by the plow. At the location of a tap for a boundary light or lighting standard, the plow is pulled above ground, a loop is placed around a stake, and the plow re-inserted

LAYING cable for extensive distances always has signified the employment of many men many hours, with high labor costs and slow progress. In such installations the really electrical part of the job was insignificant in comparison to the mechanical problem. Airport lighting in particular created a demand for some speedier installation method. In meeting that demand the field opens up other uses for the airport cable-laying methods evolved by the General Cable Corp.

As an example of the economy of operation of this method the following figures were released by R. U. St. John, manager of the San Francisco Bay Airdrome, Inc., Alameda. A total of 14,200 ft. of cable was laid for boundary lights at that airport for the following cost: Plow rental, two days at $3, $6; truck and driver (including gas), $7; tractor and driver (including gas), 7 hrs. at $4, $28; labor, $65.

Above—After laying, the ground appears as shown, is easily tamped down by a tractor

Left—Close up of cutting wheel, plow and cable feeding into the trench

Right—Cable looped around stake awaiting the installation of the concrete base for the lighting unit

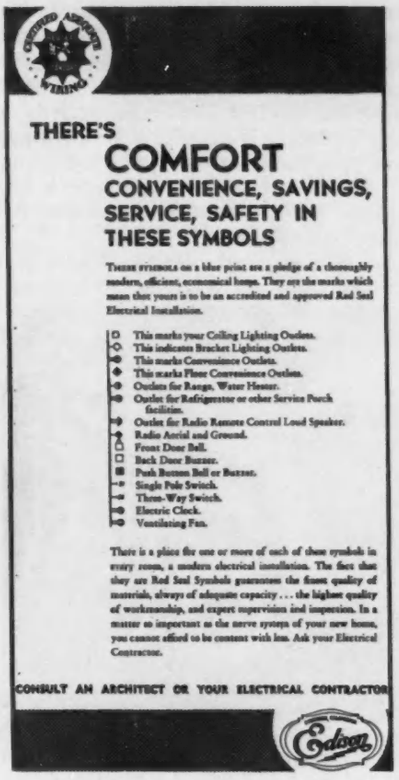
Above—Desert home of S. F. Griffith, paving company president, in Coachella Valley, served underground from the substation at the right, has 65 kw. connected in electric home equipment, pumping and lighting

Red Seal Gets New Impetus

Some Indexes Which Point To Increased Progress of The Adequate Wiring Idea

SPOKANE, *Wash., Lighting League is the latest organization to take out a Red Seal license agreement with the S.E.D., thus adding another adequate wiring promotion organization to those already successfully operating in the West*

Below—One of a series of large advertisements with which a utility is helping to sell the plan and the contractor


THERE'S
COMFORT
CONVENIENCE, SAVINGS, SERVICE, SAFETY IN THESE SYMBOLS
This marks your Ceiling Lighting Outlets.
This indicates Bracket Lighting Outlets.
This marks Convenience Outlets.
This marks Floor Convenience Outlets.
Outlets for Range, Water Heater.
Outlet for Refrigerator or other Service Porch facilities.
Outlet for Radio Remote Control Loud Speaker.
Radio Aerial and Ground.
Front Door Bell.
Back Door Buzzer.
Push Button Bell or Buzzer.
Single Pole Switch.
Three-Way Switch.
Electric Clock.
Ventilating Fan.
There is a place for one or more of each of these symbols in every room, a modern electrical installation. The fact that they are Red Seal Symbols guarantees the finest quality of materials, always of adequate capacity ... the highest quality of workmanship, and expert supervision and inspection. In a matter so important as the nerve system of your new home, you cannot afford to be content with less. Ask your Electrical Contractor.
CONSULT AN ARCHITECT OR YOUR ELECTRICAL CONTRACTOR
Edison

In the Sierra Oaks tract of fine Sacramento homes George Foss, Electragist, is making all his jobs Red Seal plus. In the C. R. Jones house, shown above, a special feature was a niche in the living room for the radio set (left). Outlets are seen for circuits to remote loud speakers with the radio on three-way switch control, giving control of music in various parts of the house

The wiring in this building shall conform to the Los Angeles City Electrical Rules and the California Red Seal Standards. The Electrical Contractor Shall arrange for the necessary inspection and shall deliver the Red Seal Certificate to the owner.
MARBLEHEAD LAND CO.

Above—This realty company requires California Red Seal standards in all of its building requirements, stamps plans with this symbol and edict. Malibu coast homes of prominent movie stars all were made to conform

Below—In speculatively-built homes containing range outlets, wired to Red Seal specifications, the Southern California Edison Co. puts this "Busy Buttons" cutout, with its adjustable arm pointing to the range outlet. It helps sell the house

For Explosive Atmospheres

Dry Cleaning Plant Equipment Requires Extra Precautionary Measures in Vaporproofing of all Electrical Equipment

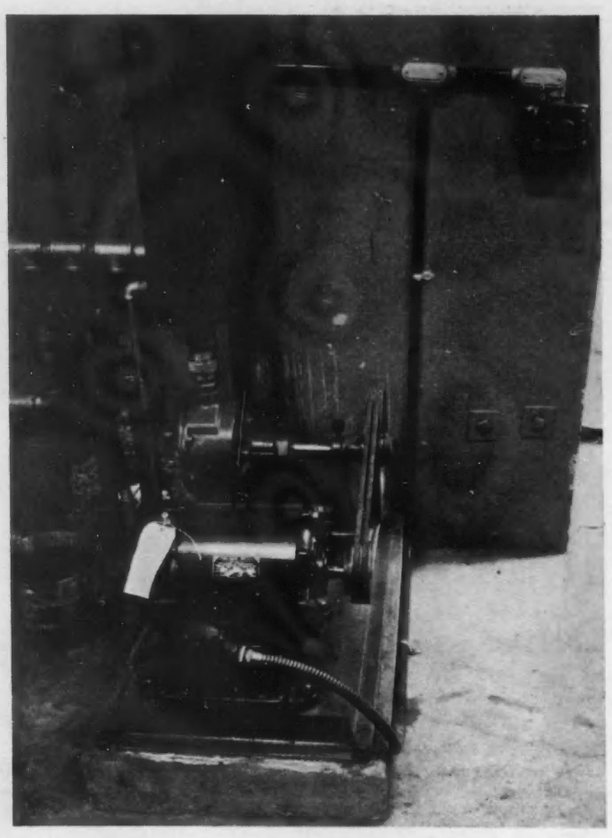
PURE high-test gasoline is used like water, in rotating dry cleaning machinery similar to laundry equipment, in the new and thoroughly modern plant of the Taco Cleaning Co., of San Francisco, for which the electrical installation was made by George Katz, Peerless Electric Co. of that city. For both the cleaning machinery and the purifying and distillation equipment to recover the gasoline, extreme caution was necessary in electrical installation to prevent any possible electrical discharge or arc in this highly explosive atmosphere.

From the main board in the garage entrance, both 3-phase power and single-phase lighting are distributed to subpanels. For the "hazardous" building the subpanel is located outside in an areaway. All control and feed wires are drawn in the same conduit to each of the Louis

The "hazardous" building subpanel, containing contactors, fuses on control circuits and externally-operated switches for equipment inside. It is located in an areaway outdoors, between buildings

Allis, especially-designed, vaporproof motors operating the equipment and to the adjacent oil-immersed, cork-gasket-fitted start and stop buttons. All flexible motor connections are made from the conduit to motor by means of bronze high pressure steam hose with standard threaded fittings sweated to the ends. The terminal boxes are of cast iron, threaded to take the flexible connectors.

Lighting fixtures are industrial reflectors with vapor proof globes attached to rigid conduit stem, all joints

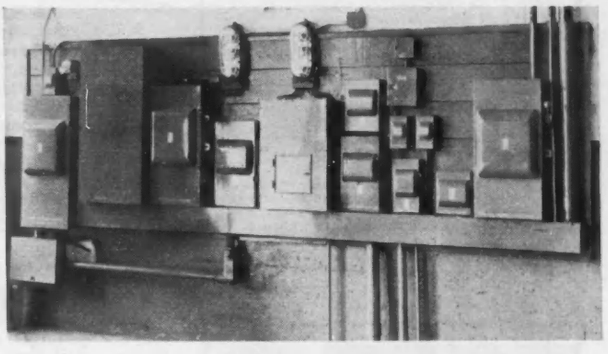


Typical motor control arrangement with oil-immersed push buttons and bronze, high pressure steam hose used for flexible motor connections

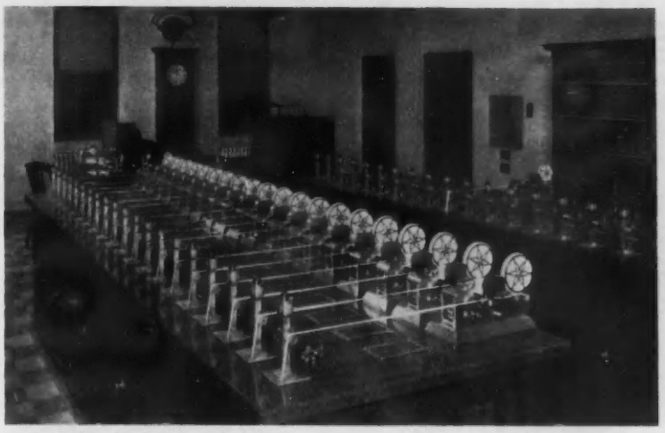
being sealed against passage of gases. All shafting and countershafting, all machinery and metal in the building is grounded to obviate possible static discharges.

Another interesting feature of the plant is a special panel on the second floor of the main building which takes care of nothing but electric irons. Every iron, at a battery of ironing boards, is equipped with an ingenious goose-neck over the board, through which the cord is fed to the iron. At the top of the goose-neck is a pilot light which indicates when the iron is on. A switch below controls both iron and pilot.

The plant includes its own garage equipped with high pressure pump equipment for car washing, air compressor for tires, elevator, floodlighted wash rack and other electrical appurtenances and tools.



Main board with special meters having pilot lights on each phase. All power, lighting, and paging system supply is distributed to the group of buildings from here



Above, left—In foreground one 20-circuit register table, with 2-pen printing registers; at rear right a second table for future equipment; at the wall the protector panel which has next to it dynamotor (charging and automatic panels not shown); at rear left, chief operator's desk (shown in detail above), master clock, and P.B.X. boards

Tacoma Electrifies Against Fires

New Automatic Alarm System Operates Despite Broken Circuit Conditions

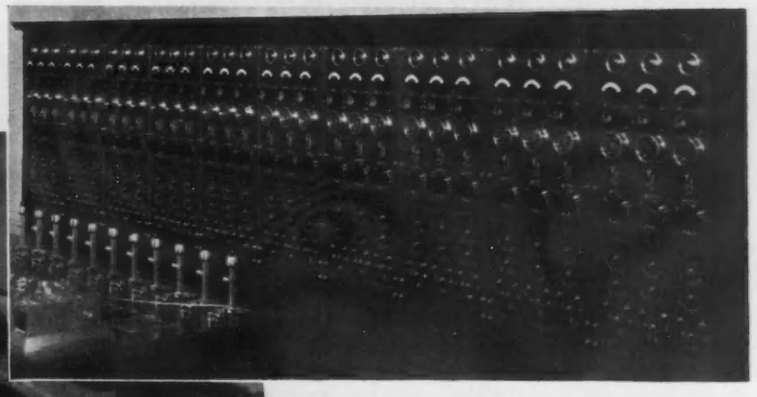
COMPLETED recently, the new automatic fire alarm system installed by the city of Tacoma, Wash., gives that Pacific Coast community the distinction of having in operation one of the most modern installations in the entire country. Like most American fire alarm systems now in service, the Degen system employed in Tacoma is of the closed circuit type but is designed for a common battery. One of its most important features is the special grounding device which provides a means of receiving alarms over a circuit even though that circuit may be broken. A broken circuit condition may obtain for an indefinite period without danger of losing an alarm.

The system as installed is equipped to service 40 alarm circuits of a maximum of 20 boxes each, and provision has been made for doubling the capacity when needed. As now installed and operating, this system serves approximately 500 signal boxes scattered throughout the municipal area.

The Pacific Coast has pioneered the use of saturated paper cables for fire-alarm and other important signal circuits and the new Tacoma installation is no exception. In addition to such existing circuits as were in use at the time when the system was rebuilt, more than five miles of new multi-circuit saturated paper cable has been installed varying in circuit capacity from 100 pairs to 15 pairs of conductors.

The entire system was installed under the direct supervision of C. L. Thompson, superintendent of fire alarms for the city of Tacoma, who organized and trained special crews of electricians for the work. The system was designed by Lewis Degen, consulting electric signal engineer of Burlingame, Calif., and the central alarm and control station equipment was built by the Diamond Electrical & Mfg. Co.

Below—Battery room supplying the fire alarm system with energy. Note the neat connections to batteries from conduit fittings



Above—Ten of the three-circuit line panels which are mounted at the opposite wall from that shown in the photo at the top of this page. Each circuit has mounted in a vertical line the instruments, pilots, and controls necessary to that circuit

Can Radio Sell Appliances?

Will the Announcer, With His "Personal Appeal" Tone, Convince Radiowners of Their Need for Irons, Toasters and Even Washing Machines? And Convincing, Can He Persuade Them to "Buy Now?" Four Western Merchandisers Think So

JUST how successful can radio become as a medium for really selling and not merely advertising electric appliances? What types and sizes of appliances are best suited to this medium? What offers can or should be made to make this selling more effective, to bring buyers into the stores? What program is best and when should it be broadcast?

These questions arise in the minds of those dealers and distributors who contemplate using "the air" as a means of increasing sales, now that radio has turned to direct merchandising. Electric appliances, on the whole, are unlike any other commodity being sold over the radio. They are bought for the enrichment of life, and not for its sustenance. An article such as a cigar, cigarette, tooth paste, or an item of food lends itself well to radio selling because the prospect is continually aware of the need. These are in universal and daily use. The listener can and does mentally determine to purchase the advertised article on the same or the following day. Moreover, the product is small, comes within the scope of necessities of life and requires a minimum outlay of money.

Not so with an electric appliance. The price is usually large enough to require more deliberate thought, the need is not so continually felt, the sales presentation is different and more difficult, and the prospect forgets an appliance need too easily because electric dealers are not so numerous as drug stores.

For these reasons and others, dealers have been afraid to use radio as a selling agent and little information is available on the real power of the microphone in this field. At least four Western agencies have gone on the air, however, and their experiences invite attention because of the difference.

In Colorado

Interesting because of its merchandising success is a a four-month-old program sponsored daily by the Public Service Co. of Colorado over Denver station KFEL. Every morning at 11 o'clock the program opens with "Among My Souvenirs" as a theme song. Then, for half an hour, six or seven records are played and the musical program is interspersed with homely talks on the single appliance which the company is then featuring.

Electric irons were tried first. Results were immediate. To meet the demand, irons were drawn from eleven offices outside the Denver territory for, of the 400 irons sold in six weeks solely by broadcast, 95 per cent were sold there. Calls and cards brought irons to customers on approval, but not one was returned except as exchange for a higher priced article. As an attractive sales help, the price was set at $4.95, with nothing down and $1 a month on the electric bill.

After the irons came electric percolators. The story was repeated, with 400 going in a few weeks. A third campaign is now featuring waffle irons.

What are the success attributes of this broadcast? Gene Buck, general commercial manager, and E. M. Rowland, superintendent of the electric merchandising department, studied customer reaction closely and now believe that they have learned some of the fundamentals which govern such radio merchandising in their territory.

Various morning hours were tried. At 9, little action was enticed. At 10, the reaction was slightly better, but insufficient. At 10:30, inquiries swelled in volume. There seemed to be a rising curve throughout the morning, but inquiries on programs after 11 o'clock diminished, so back to 11 the program was set and there it stays. Mr. Buck ascribes this to the fact that at 11 o'clock the housewife turns on the radio for relaxation and hears the program. Before, she is too busy with her work; after, she is preparing or going out to lunch. At this hour, also, customers are more receptive to a shopper's guide than to a jazz orchestra, so a real sales program can be presented.

One reason for the success of the appeal is that the price of the really small appliance comes within the household budget and there is no need to consult the husband on the purchase. The desire may be satisfied immediately. These radio users find that a limited quantity of an appliance at a bargain price is needed to build sales. The price and scarcity must promote an

urge to "buy it now." The article must enjoy public acceptance, too.

Besides promoting direct sales, the radio advertising paves the way for selling other load building appliances by the new business representatives, affording more work for salesmen rather than substituting for them. Further, it is a fine company-dealer activity for whatever benefits accrue to the company are reflected favorably in sales by dealers throughout the radio-blanketed territory. In fact, the program sells more for the latter than for the sponsor, investigation proved. Inquiries from outside the company territory are referred to the nearest dealer.

In California

Totally different in inception and appeal is the selling method used by E. H. Peffer, of Peffer's, in Stockton, Calif. On the whole, this ardent advertiser sells Peffer's and not individual appliances.

At first, Mr. Peffer started radio station KGDM and ran it at his own expense, but he now makes it pay for itself with sponsored programs at night. The station is used for store advertising at 6 a. m. and 6 p. m. and in between programs at night. Music constitutes the main part of the half-day broadcast, but catchy announcements and methods of announcing enhance the sales story.

Among the best of the tricks employed is a gossipy item such as, "Come on down in front of Peffers and see the new auto radio they are putting in Jack Jones's car. Jack is going on a trip to Yosemite and wanted to be able to select his own program. And this auto radio us just the thing. Small, inexpensive,—" and the announcer tells facts about the radio. Natural curiosity will often lead the listener to follow the announcer's advice, and another sale is on the way.

Interesting bits of gossip form much of the sales talk, for they often are tied cleverly with a reference to the store or to some article for sale.

Especially does radio sell tubes, Mr. Peffer has discovered, and in full sets, for while listening to a radio, an owner will realize the discomfort and inconvenience which might be caused by a balky tube.

Mr. Peffer's merchandising test, "Does it pay?" is answered affirmatively by radio.

Byington Electric Corp., San Francisco, specialists in radio themselves, logically use it as a means of getting more business. This firm does not confine itself to one

Radio sells itself and its accessories. This volume of tubes will be sold via radio—and quickly

station, but broadcasts daily for one hour from one, an hour a week from another, and uses "off" time (when no other advertiser has purchased the air for a period) on two others.

Nothing but records are used here also, but the announcements get immediate action from listening owners of radios with "that tired feeling" for, in effect, the announcer says simply, "Call By and someone will be right out to fix your radio and bring it out right." If something is wrong with the set, the owner usually will get right to the telephone to have the trouble remedied. The simple appeal has built a sizeable business.

These three organizations have enjoyed reasonable

Service cars like these answer calls from troubled radiowners

success in selling small appliances or service through the microphone, but a distributor in San Francisco has also started broadcasting and his problem is different. Ernest Ingold, Inc., distributor of Cinderella washing machines, since July 1 has been experimenting with a daily broadcast of records and announcements. Selling a larger and more expensive appliance, one that while enjoying public acceptance is not purchased without considerable deliberation, this distributor has a double job of selling and promotion. He is promoting in order that the dealers may sell. In his position, Mr. Ingold finds it difficult to obtain an accurate record of results, but if the test broadcasts now being tried prove that such large appliances as washing machines can be sold from the air, radio will have another customer.

And with the success of these pioneers, in actually selling, still more dealers and distributors of electric appliances will become sponsors of radio hours. And now that other advertisers have popularized such ills as athlete's foot, halitosis and dry-mouth, what dealer advertiser will create "washer wrinkles?"

▼

Zooming Sales With Airplanes

ELECTRICAL dealers in the territory of The Washington Water Power Company, of Spokane, benefited by a recent campaign of the company for the sale of lamps when, instead of selling in a small campaign in which all employees would join, an "airplane campaign" was aimed to increase sales through dealers.

In staging this project, the power company purchased a large quantity of airplanes of the type which ordinarily sells for 50 cents in a novelty store, but which cost the company only 12 cents. This cost was absorbed by the dealers and through them by the customers who bought the cartons of lamps at the regular price, instead of sale reductions which regularly are also 12 cents.

Campaign announcements were carried in all newspapers, and special displays were featured in the company's stores. As a better advertising method, two or three boys in each school were given airplanes with instructions that the only way to get another was to buy a carton of six lamps from any dealer. The news spread rapidly, with the result that many parents were practically coerced into buying a carton of lamps that the boy might have an airplane.

Washer Grief Is This Man's Meat

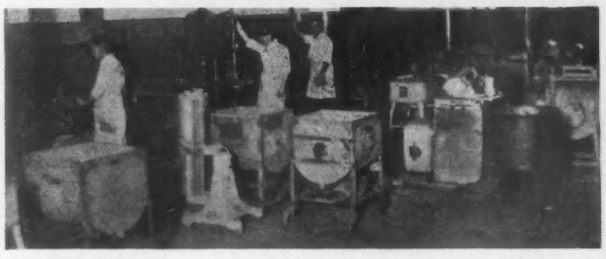
William Vogel Learned Many Things in Six Years, But Most Important Was an Idea of What Constitutes "Proper Selling"

IF WASHING machines were properly sold in the first place, a large percentage of the service calls now made would be unnecessary. And this opinion of William Vogel, of the Washing Machine Service Co., in Los Angeles, means something, for Mr. Vogel now has the largest establishment in the country devoted exclusively to servicing washers. From a cubby hole with a shared telephone, the business has grown until seven service trucks are now in the field answering from 100 to 200 calls a day. Experience with thousands of anaemic washing machines which have passed through his hands has shown that much of the grief is avoidable.

"Ninety per cent of all service calls on the older types of washing machines are due to a failure on the part of the housewife to oil the motor adequately," he avers, adding, "We never conclude an interview with the housewife without reminding her again of the importance of oiling the machine."

Had the salesman properly emphasized this point, Mr. Vogel believes, many service calls would have been obviated. Had the buyer been instructed further to use plenty of water and not to overload the machine, service demands would be reduced to a minimum. Few women know how to use rollers to best advantage, frequently bunching the clothes in the middle and overloading the motor while prematurely wearing out the rollers. Every dealer should take the pains to demonstrate good practice if he wishes satisfied customers through lower upkeep, this service expert maintains.

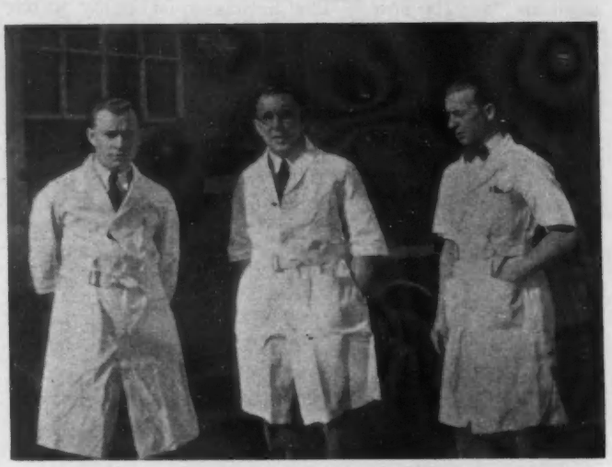
Grease-encased machines should have an overhauling once a year, Mr. Vogel found out, if only to prove that they do not need it. And another emphatic view about grease is that it pays to use the best. An inferior product will impede the operation of the motor. Dark colored



Here anaemic washing machines regain vigor

grease should not be used because it may ooze out and ruin fine clothes—and dispositions.

This maxim of "proper selling" he has frequently expressed to dealers. It has bettered his relationships and business, for a portion of the company's business consists of contracts with certain manufacturers and dealers to handle all of their servicing. For this work a charge of $1 per call and $1.25 per hour for shop work is made. For the growing volume of direct public calls, a minimum charge of $1.50 is made.



Wenzl Seastrom, left, and Irvin Neeb, right, are now partners with former employer, William Vogel

All terms are cash, and the service men are taught to sell their work to the customer. The lowered overhead because of the omission of the collection and credit departments is a good talking point for reasonable prices, and a customer is usually satisfied to pay the cash and have the work done.

To protect dealers and manufacturers whom he serves, Mr. Vogel sells no machines at retail. If a customer needs or is in the market for a new washer, the information is passed to the dealer, if it is a dealer-service call, or to the power companies if no make is specified.

To better supply needed parts for old and orphaned machines, the manufacture of parts and rollers was started through a subsidiary company. So important has

This service crew remedies what the boss calls "improper selling"

this phase become that the company did a $52,000 business in parts last year and supplied 16,000 rollers to the trade.

How long will this thriving business last? Mr. Vogel recently made partners of two of his employees, Wenzl Seastrom and Irvin Neeb, and all three are optimistic. "Thousands of washing machines are sold each year in the West," say they, "and even if the dealers take our advice and sell the machines properly with instructions on best washing practice, these washers will require service in from three to five years. That's our future."

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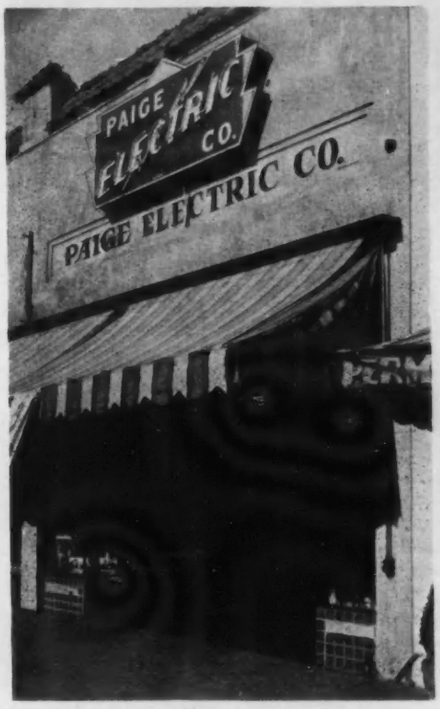
CORRECTION—On page 458, ELECTRICAL WEST, May 15, 1931, the formula should read:

$$\text{Boiler Efficiency} = 100 - \frac{100\ (\text{Item 1} + \text{Item 2} + \text{Item 3})}{\text{B.t.u. per pound of fuel}}$$

The Shop That Jim Paige Built

San Bernardino Contractor-Dealer Makes Two Sales Grow Where Only One Grew Before

The main store is a long corridor, with open tables displaying appliances on each side. Cards hanging from the ceiling indicate departments or groupings of appliances, with radio and refrigerators up front



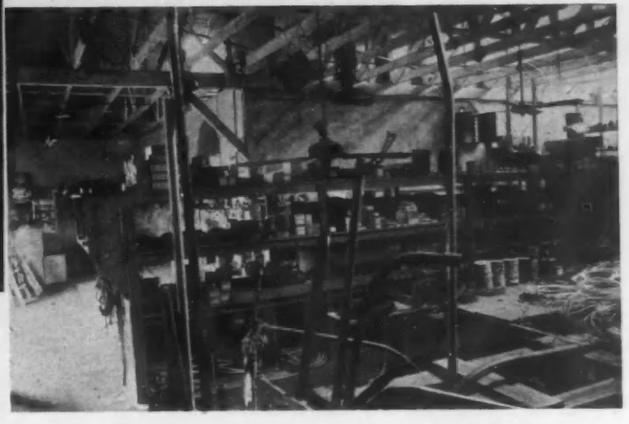
New quarters of the Paige Electric Co. on one of San Bernardino's busiest streets. The convenient lamp counter at the entrance, attractive window displays and neon sign mark the bright spot for electrical merchandise

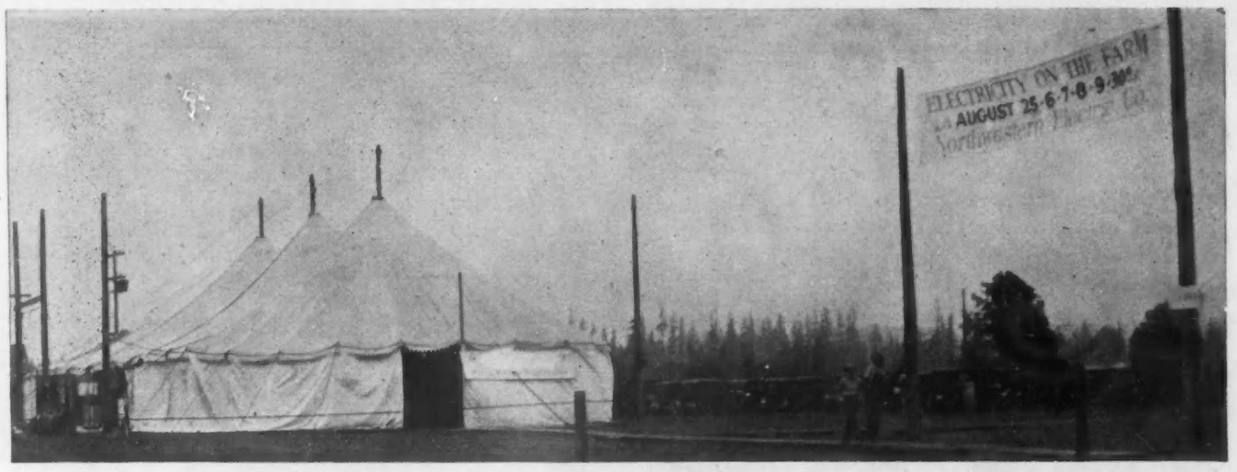
BELIEVING *in assigning responsibility, Mr. Paige displays the names of those in charge of various departments. The staff includes D. L. McAdams, radio and lighting fixture specialist; C. P. Rice, construction superintendent; I. V. Iverster, refrigeration specialist; Harold Painter, store manager; and Sue Reister, bookkeeping department*

And this is Jim Paige, himself, in his office and estimating room

At the rear of the store near the office is a large fixture display room with comfortable living room furniture and fixtures not too thickly placed on the ceiling to obscure their individual merits. Arranged on alternate circuits those lighted at any one time are spaced far apart

Below—A spacious shop and storage warehouse extends across three stores at the rear. All ladders, heavy tools and apparatus are painted a distinctive orange, with the company name on them, advertising the firm. The shop has a drive-in entrance at the alley and stock is arranged for quick and easy loading





Above—Special fair of its own was the Farm show of the Northwestern Electric Co., at Battleground, Wash., in which dealers and manufacturers took part

Summer's Always Fair Weather

Since All Counties Hold Fairs, it Behooves Electrical Dealers to Utilize Them for Business Promotion and Sales Purposes

LATE summer and autumn are county fair seasons. During these months exhibits are held in all sections of the country, in large communities and small. Power companies and dealers find these an excellent opportunity to reach in wholesale those rural customers who, for economic reasons, are infrequently contacted by electrical representatives. Unique among utility company cooperative attempts to popularize uses of electricity in rural territories was the experiment with a one-week farm show conducted by the Northwestern Electric Co., of Portland, at Battleground, Wash., near the center of the principal farming territory served by the company. And not only did the exhibit "sell" electric service, but visitors contributed valuable sales leads through the medium of questionnaires. These were later used in making sales.

Financed wholly by the utility, the show consisted of exhibits housed in a tent, with regular programs of lectures and motion pictures to which the public was invited free. Twenty-two dealers, wholesalers and manufacturers participated by invitation in exhibiting equipment suitable for farm use, but no charge was made for such space. Seven of the exhibitors contributed prizes for the drawing held every afternoon and evening, and one flour mill served hot biscuits and coffee.

Though regular programs were scheduled every afternoon and evening, visitors were invited to call at any time, and exhibitors kept their displays in operation from early morning until late evening. The afternoon program, which started at 2:30, consisted of a cooking school,with the demonstration of all sorts of household and kitchen equipment, followed by a lecture on some subject pertinent to the use of electricity on the farm. The evening program started at 7:30 with "Amos 'n Andy" over the radio, after which there were lectures until 9 p.m., when moving pictures were shown. The pictures combined educational features, supplied largely by the General Electric Co., and comedies secured from local film exchanges.

Speakers included company officials, college professors, directors of C.R.E.A.'s, agricultural agents, county health officers, local farmers, and representatives of exhibitors. Among the subjects discussed were matters of company policy with respect to rural extensions, the application of electricity to farm operations, results of

K. D. Miller, longest established electrical contractor-dealer in Whittier, Calif., has long made use of the Whittier Avacado Show and Exposition for the demonstration of electrical wares for the ranch home

experiments with electricity on the farm, farm sanitation and a number of subjects describing particular electrical applications in dairying, poultry raising and general farming.

To announce the show, one advertisement was run twice in two papers and once in another paper published in the territory. In addition, 7,000 program circulars were printed and mailed to the residents of the surrounding territory, both customers and non-customers.

Total attendance for the week was estimated at 5,500, the average daily attendance being about 750 adults and 150 children. Registrations were taken from as many adult visitors as possible and a total of 2,840 were received; in some cases, the same person attended and registered more than once, but this number represented the registration of 1,731 different persons. From the address record on the registration cards, it was learned that

An exhibit of dairy equipment by a dealer in the power company's farm show. This exhibit was typical of many which the trade provided

these visitors came from nineteen towns and rural routes in the vicinity, with a scattered few from more remote localities.

Besides the name and address asked for on the registration card, other questions were asked, the answers to which would yield valuable information to the company. Of the 1,731 registrations, 928 were customers of the company, 176 were not, and 627 did not answer; 820

Lecture platform for talks and demonstrations at the Battleground farm show. Domestic equipment was featured the day this picture was taken

were benefited by the show, three were not, and 908 were non-committal. Asked if they had a radio, 705 replied affirmatively, 541 negatively, while 485 were uncommunicative on this point. One portion of the registration card was designed to give the registrant an opportunity to express an interest in any farm or home appliance. The devices in which the greatest interest was shown were pumps, 203; ranges, 144; washing machines, 115; refrigerators, 54; radios, 44; ironers, 34.

A suitable site of about 12 acres was found at the edge of town and leased from the owner. A tent 135 x 55 ft. housed the exhibits around the walls, while the lecture platform was at one end with seating space in the middle. The cooking school was conducted from the platform, where an elaborate exhibit of household cooking equipment was maintained by the company at all times. Most of the equipment exhibited, however, which included all kinds of electrically operated devices, was displayed by dealers from Portland and Vancouver, Wash. The tent was wired temporarily so that all the equipment could be shown in operation, and every dealer had an attendant at the exhibit for the purpose of demonstrating and exhibiting the equipment shown.

The many letters of commendation received by the company from customers and prospects attending the show have led the company to express satisfaction with the results, which are deemed commensurate with the expense involved.

So many are the county fairs in the territory of the San Joaquin Light & Power Corp., that this standard display was designed to take from one to the other. Actual demonstration and dealer sales through its subsidiary Valley Electrical Supply Company plan are made from these exhibits. The portable layout each year is planned and set up by J. U. Berry, advertising manager and display artist for the latter

Colorado Demonstration Booth Becomes Laundry

THAT electric washing machines, ironers, and other merchandise were not allowed in the agricultural tent at the Arvada (Colo.) Harvest Home festival made no difference to E. Widergren, salesman in the resale department of the Public Service Company of Colorado. He simply "sold" the local banker, the carnival's executive committee, the power company, and others on the idea that he was going to demonstrate Thor washing machines and ironers in the agricultural tent and not on the street where commercial exhibits were supposed to be.

So, when the Arvada fair opened Mr. Widergren's booth was just inside the main entrance. Within a short time the crowd watching him iron clothes, curtains, and sheets was so large that a policeman had to clear a passageway. Immediately Widergren sent to Denver, five miles, for another Thor Laundress. With an assistant, he operated both appliances and showed the farmers' wives how easily electricity does the work they had been doing by strong arm and knuckle methods.

In view of the fact that Arvada is outside the territory being campaigned by Denver salesmen, Mr. Widergren could not sell his demonstrators on the lot, but instead of taking them back to the B. K. Sweeney Electric Company, distributor of Thor products in Denver, he disposed of them to Denver women who had seen the performance. One of the customers was a Japanese wife who could talk no English. However, she made her wants known to her husband and he signed on the dotted line, accompanying this gesture with a $10 down payment.

As a result of Mr. Widergren's coup in getting an exposed location at the festival, he developed 25 "hot" leads, most of which were closed within a few days. The sales were made in Arvada Electric Company domain. The Arvada Electric has its own distribution system, buying power from the Public Service Company of Colorado. W. C. Sterne, owner of the Arvada system, invited the salesman to build power load to his heart's content, even though the Arvada company was not interested in merchandising exploits conducted by Denver firms.

A little personal selling plus a great deal of initiative secured for Mr. Widergren a booth, an audience and a list of prospects

The Thor campaign was staged by the Sweeney company in co-operation with the Public Service Company of Colorado. Sweeney furnished the merchandise sold by salesmen and the power company underwrote the financial end of the deal, enabling customers to use equipment while paying for it. All expenses incurred were split 50-50. Previous campaigns have demonstrated this co-operative method to be a swift load builder for Public Service Company and a swift turnover system for the Sweeney organization.

An interesting sidelight on Mr. Widergren's sales methods is the one whereby he conspired with the local telephone operator to advise him who had washing on the line. Invitations to housewives who wanted electric ironing done brought plenty of material and interested prospects to the Thor booth.

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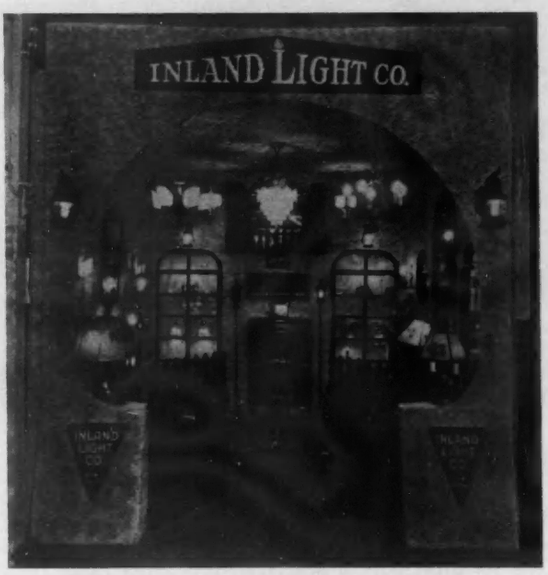
More Than a Fair Display



EVERY year at the Fresno (Calif.) district fair, the Inland Light Company, Fresno, has a display booth. This display contains props which give it the appearance of a home. Lighting fixtures, in which the company specializes, are shown expertly, the few displayed adding appeal to each unit shown.

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How About Your Lease?

JOHN B, of the B Electric Co., had occupied the corner of Blaine and First Ave. for four years and nine months under a five-year lease. During that time the district had developed rapidly as a business center and B's establishment occupied one of the most prominent locations. Through extensive advertising, efficient service and improved facilities he had established a brisk business.

He went to the landlord to renew the agreement, but the landlord shook his head. "A large downtown electrical store, wishing to establish a branch, has purchased the lease for fifteen years at a figure much higher than that you are paying. I am now preparing a notice that you will have to move as soon as your lease is up."

In inquiring about the adjoining property, B learned that the store had not only leased his location, but also

the property for a half block each way in order to keep out competitors. The space not needed would be sublet to concerns in other lines.

Such a fictitious but altogether possible story indicates the wiseness of carefully preparing leases and of securing an option providing that the lease may be renewed at will.

While in larger cities leases for 99 years are not unusual, one of from five to fifteen years is more advantageous to the average electrical establishment, especially if the right to renew is given.

In such leases the rental is usually agreed upon for a shorter term of years and at the end of that time a revaluation of the property is made for the next period determined. Such leasehold interests are often very valuable because the price of the real estate may rise considerably before time of revaluation comes around, thus allowing for profitable subletting or the assigning or cancelling of the lease at a highly profitable figure.

A lease, being a contract, should be made definite and complete and not leave parts to oral understandings which frequently result in litigation. Thus, the lease should specify the obligations of the landlord as to repairs, improvements and general upkeep; how much time he has to repair or rebuild in case of fire, flood or other accident; the tenant's obligations as to gas, water and light bills, plumbing repairs and installations; information on assigning the lease; whether tenant may take away detachable improvements that he may add and whether he shall be reimbursed by payment if said improvements become a part of the real estate.

Occasionally leases contain a joker that is disastrous to the tenant. If the lease provides that the tenant agrees to "return and redeliver the premises at the end of the term, in good order and condition, reasonable wear and tear only excepted," he is bound to repair any damage caused by fire, flood, etc. Accordingly, it is wise to put into such a lease the additional clause, "damage by fire and other unavoidable accidents also excepted."

An intelligible, written contract is worth more than its weight in gold.

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"LOAD-BUILDING WITH ELECTRIC FRY KETTLES" is a late report of the N.E.L.A. commercial cooking committee. The booklet explains the new temperature-regulating kettles from the standpoint of money saving, reduced fire hazard, time saving, and more agreeable working conditions in kitchens. In actual installations, fry kettles develop from 700 to 2,000 kw.-hr. per year per kilowatt connected, a sizeable load. Copies may be obtained from N.E.L.A. offices, 420 Lexington Ave., New York.

There's an Art In Wiring Lamps

BY EXERCISING a little care and giving special service, W. L. Moore, manager of the Dear Electric Co., Alhambra, Calif., has built a sizeable business in wiring art lamps. As many as 25 lamps a week have come into the shop, enough to keep one man busy, and even during the dull summer season the department enjoys a steady profit.

It was about a year and a half ago that Mr. Moore came to realize the possibilities of wiring lamps of this type. Women had succumbed to the craze of making lamps out of a variety of articles. A number of schools had started in Alhambra and neighboring cities to which women were taking knick-knacks to learn how to decorate them. Old fashioned perfume bottles, vases, antequated kerosene lamps, brass or nickel plated, old fashioned glass lamps, oddly shaped bottles, and many other articles, women learned, could be made into artistic bases for lamps. And the wiring was an important part of the decorative scheme.

After Mr. Moore had wired a few of these he concluded that he, as well as the average electrician, was not giving enough attention to the details. He concluded that if he would make a sort of science of it, do it just a little better than the average, putting some real art into the job, he could please the women and build a volume of business.

The first thing he determined to do was to adjust the height of the cluster stem to suit the shade in place of using the regular standard stems out of stock. The average electrician, he knew, used standard clusters regardless of whether or not they were the right height. He began by asking the women who brought in lamps for wiring to bring down the shades also in order that he might have his stems raised to the right height. This he felt was important and he soon saw that he was not mistaken.

In drilling the hole at the bottom he made it large enough to hold a security nipple so that there would never be any wear on the cord. He established his own spraying room so that he could color the fixtures to match the colorings in the lamps instead of sticking on plain brass fixtures and letting it go at that. He did not stop with merely approximating the color scheme, he took the trouble to blend in colors until the fixtures matched the lamp perfectly. The top for the vase was given especial care and even a cord was selected that matched.

A charge of $3.50 is made for a two-lamp cluster job and $2.50 on a one-lamp job. This price covers the cluster and fittings, the cord, attachments, top for vase and coloring. Those prices are not large and yet they yield a reasonable profit.

When an old brass lamp or a nickel plated lamp comes in, additional business is secured, for Mr. Moore has installed a plating department and he usually succeeds in getting such customers to see the value of re-plating their old lamps and making them look exactly as good as the day they came from the factory.

Results were almost instantaneous and no money was spent on advertising. The first woman told another and she another. At the present time lamps are coming in to the Dear Electric Co. from cities and towns twenty miles away. The firm has customers of this kind in Pasadena, Glendale, Altadena, Monterey Park, Monrovia, Arcadia and Covina as well as in the home city of Alhambra. Some women have brought in several lamps.

Editors Take Part in Mokelumne Dedicatory Ceremonies

SHOWN over the entire Mokelumne project by the Pacific Gas and Electric Co., in order, according to its president, A. F. Hockenbeamer, host to the expedition, that they might learn of the company's labors and appreciate its significance as a truly Western operation for and by Western people, three hundred editors and newspaper men of northern California were dedicatees of the project on behalf of the public they represent on July 10 at Tiger Creek plant. The entire trip was a triumph of the same type of engineering organization which made the project itself a successful coordination of six major engineering works for northern and central California electric energy supply over a period of five years.

News men were taken first to Salt Springs Dam where, after examination of the work, an evening entertainment program was given under the stars. A. F. Hockenbeamer was program director Al. C. Joy's first speaker, explaining the company's reason for bringing the news men to the mountains because it was impossible to bring any kind of mountain back to them, and that the public should know something of this labor. He goodnaturedly debunked several of the charges made against the company, pointing out their absurdity in the face of facts evident from examination of the project itself.

P. M. Downing spoke of the operations of the company and the place this development occupied in its electrical supply network. O. W. Peterson, construction superintendent for the entire job, related some of the engineering problems that had been mastered during the course of the work. Several of the news men made short talks, and motion pictures, taken during construction, showed graphically the methods and the magnitude of the undertaking.

On the following morning, after a night spent in construction camp quarters, the party went in buses to the Tiger Creek power plant, viewing the flume en route, and there dedicatory ceremonies were held.

First introduced by Mr. Hockenbeamer was A. G. Wishon, whom he termed the dean of the power industry in California, vice-chairman of the board of the San Joaquin Light & Power Corp. Mr. Wishon made a touching talk upon the electrification of the home and what it meant to the mothers. Next speaker was J. P. Jollyman, introduced as the company's Steinmetz, designing electrical engineer for the project. He described the electrical works and their connection with the system of the company. Mr. Hockenbeamer then made acknowledgment to a long list of California and Western manufacturers, from whom everything possible necessary to the job had been purchased, redeclaring the company's policy of patronage of home industries.

"The dean of the newspaper men of the state," as he had been termed, was then asked to turn on the plant in the interest of the public. Irving G. Martin, publisher of the Stockton *Record* and former member of the Railroad Commission, accepted the honor after a talk concerning regulation, public utilities and public ownership.

He urged strengthening of regulation, more interest in it on the part of the public, and explained the impossibility either of politics or private business affecting its decisions under its present organization plan. He commended private owners for their initiative and public interest, said public ownership should come only piecemeal and then with the approval of private owners and only when the public showed an overwhelming desire to assume the task of operation with its attendant responsibilities. He made a plea to the editors to sponsor legislation which would place the service of utilities under taxation, regardless of ownership by public or private capital. At present cities escape support of state expenses, and enjoy the benefits of state administration at the expense of other districts because they do not pay taxes on municipal enterprises, Mr. Martin explained in showing the unfairness of the present system.

With the words, "Here it is, use it," addressed to the public, Mr. Martin turned on the small control wheel on one of the four waterwheels and the plant was soon in operation.

Discussing events after the plant had been turned on are (left to right) O. W. Peterson, construction superintendent for the project; P. M. Downing, P.G. & E. vice-president in charge of electrical construction and operation; L. Liati, publisher of "L'Italia"; and F. S. Myrtle, of the P.G. & E.

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Seattle Mayor Recalled; J. D. Ross Reinstated

A reversal of status in Seattle's political situation came last month with the recall of Mayor Frank Edwards and the subsequent reinstatement in office of J. D. Ross, recently dismissed City Light superintendent.

The mayor was recalled by a vote of 35,657 to 21,836 in a city election held July 13. Mr. Ross succeeds W. Chester Morse, former city engineer, who was named City Light superintendent by Mayor Edwards May 4.

Robert H. Harlin, president of the city council, has been named to fill the unexpired term of Mayor Edwards. Resignations of all city department heads have been requested by Mr. Harlin, including those of George B. Avery, superintendent of public utilities, and R. H. Thomsen, city engineer. Mr. Ross has been appointed chairman of the board of public works by Mr. Harlin.

Commenting on the election and his own return to office, Mr. Ross said: "The success of the recall serves notice on friends and foes of public ownership that Seattle is definitely committed to protection and progress for

A. F. Hockenbeamer and A. G. Wishon (left) spoke first; Irving G. Martin (center), publisher of the Stockton "Record," turned on the plant; and J. P. Jollyman described the project's electrical features which he had designed

its city owned utility. City Light now can go on to greater things, its future and credit safer after this election."

Mr. Ross returned to Seattle early last month from New York where he had been engaged in making a study of the engineering problems involved in harnessing the St. Lawrence River for a 2,000,000-hp. power development.

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Double Investigation for L.A. Water & Power Dept.

Following closely on the appointment of two committees ostensibly to do the same job of investigating the Los Angeles Department of Water and Power, engineers of that department announced the submission of a new rate schedule to the city council for approval in ordinance form. The schedule involves only slight adjustments to correct minor inequalities and will affect the present annual revenues (about $16,000,000) not more than $40,000 one way or the other.

Mayor Porter appointed the first investigating body. On that group will sit nine men, G. J. Kuhrts, Los Angeles Railway Corp. president, a lawyer, four business men, two bankers, and a realtor. They have been invested with unlimited authority to investigate both the water and power bureaus and the acts of the water and power commission members.

C. H. Randall, city council head, appointed the second committee one week later (July 8) and empowered it to subpena witnesses, demand documents and employ a court reporter. Its membership was drawn from the council.

Opposition to the expenditure of water and power department funds to meet the expense of the mayor's committee has been indicated by the members of the water and power commission.

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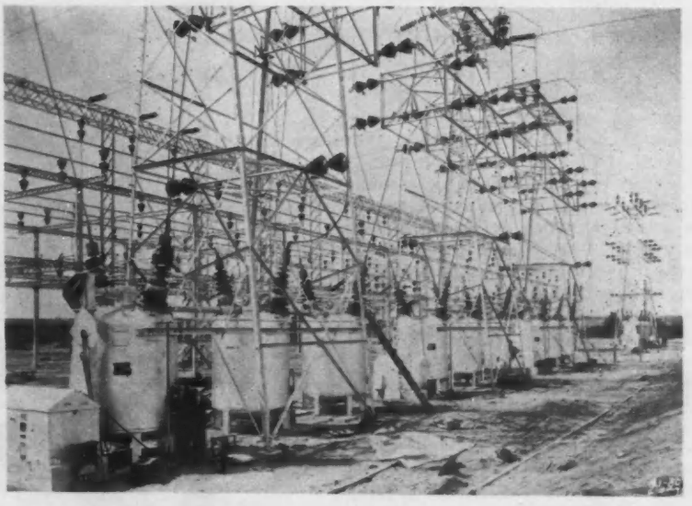
Colorado Project to Benefit Farmers

A 3,000-kw. hydro-electric plant is to be built on the Colorado River near Palisade, Colo., according to Clare N. Stannard, vice-president and general manager of Public Service Company of Colorado, Denver.

The project is a result of the triangular contract entered into by the U.S. Government, Grand Valley Water Users Assn., a reclamation area, and Public Service Co. The plant is to be designed by Reclamation Bureau engineers, will revert to the Water Users group in 25 years, and will be financed by Public Service Co.

The initial enterprise, which will involve $215,000, will be ready for operation about Sept. 1, 1932. In addition, Public Service Co. will extend transmission lines and build substations to carry energy from the new hydro station to Grand Junction, a distance of nearly 20 mi. Eventually the plant is to be tied in with the company's central system.

Herndon Substation in Operation



ADDING 75,000 kw. to the power resources of the San Joaquin Light & Power Corp.'s system, this substation at Herndon, about 10 miles north of Fresno, Calif., was placed in operation June 30. From this station a 100-mile, 220-kv. transmission line has been built to Bellota, where it ties in with the Pacific Gas and Electric system. From Bellota the line extends to the Wilson substation, using the steel towers of the present 220-kv. Sacramento-Merced line erected by the Great Western Power Co. This interconnection makes available to the San Joaquin system electric power from the Mokelumne project and the San Francisco P.G. & E. steam plants.

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Small Cut Ordered in Grays Harbor Rates

Exercising its prerogative in the matter of excluding from the rate base the value of property alleged not to be useful in the public service and establishing 7 per cent as the maximum net return upon the rate base, the Washington Department of Public Works on June 24 ordered a slight reduction in certain schedules of the rates of the Grays Harbor Railway & Light Co., Aberdeen. Urban and rural residential rates and street lighting were picked for reduction in view of the fact that previous rate reductions had been applied largely to the company's commercial schedules. The reductions are expected to lower the company's gross earnings by $25,000, cutting down its calculated rate of net return from 7.79 per cent to 7 per cent.

In the valuation proceedings the Department disregarded the value found as of 1915 for the combined property and segregated the electric property from the railway property. It excluded from the electric property the value of two-thirds of a tract of land, a 400-kw. turbo generator with switch board panels in plant No. 2, certain distribution and substation transformers in storage, and 85 per cent of the cost of a transmission line from plant No. 1 to Cosmopolis.

Reproduction cost less depreciation was the principal basis on which the rate base valuation was established, though other factors were considered. The property was found to be in 83 per cent condition, and the rate base valuation of the property was found to be $3,280,745.

In its calculation of rate of return the Department estimated gross revenues in a normal year, estimated operating expenses including 2 per cent of the gross instead of 3 per cent for the management fee to the Federal Light & Traction Co., allowed for 3½ per cent depreciation on operating capital exclusive of land, working capital, and going value, allowed for taxes and uncollectable accounts and found a net operating income of $255,539 amounting to 7.79 per cent of the established rate base. The order then said, "In view of the present rates of interest and the trend of interest rates, the Department finds that the earnings of respondent are excessive in so far as they exceed a return of 7 per cent upon the rate base."

New rates established for complete electric service in urban residences, which became effective July 1, begin with the top step of 6½c. and scale down to 1½c. For complete electric service in rural areas, the rate established commenced at 7½c. and scaled down to 2c. Street lighting rates were likewise slightly reduced, the reduction being made retroactive to March 1, 1931.

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THE GOLD BEACH (ORE.) ELECTRIC COMPANY has filed with the Supreme Court a petition for rehearing of its suit for damages against the Gold Beach Utilities Inc. (See ELECTRICAL WEST, July 1, 1931.)

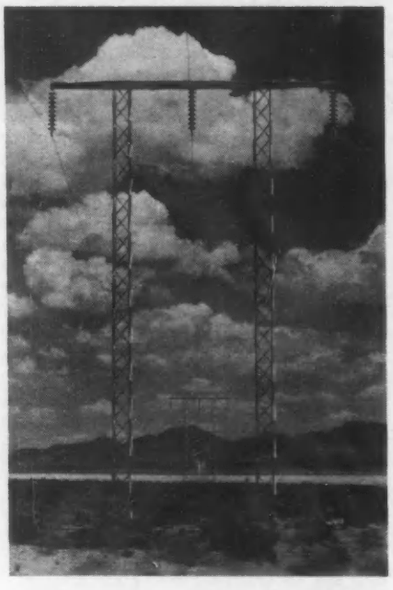
Power Now Obtainable for Hoover Dam Activities

MAKING available electric power for the construction of the Boulder Canyon project and marking the completion of the first step in the work, A. B. West, president of The Nevada-California Electric Corp., on June 27 threw a switch which delivered 40,000 hp. at the dam site. Power is delivered over the 225-mi., 132-kv. transmission line from San Bernardino built by The Southern Sierras Power Co.

The ceremony of turning on the power followed a luncheon in which prominent newspaper men, officials of the Reclamation Service, representatives of the Six Companies, Inc., and power company officials participated. During the day a boat trip was taken down the Colorado River past the dam site in Black Canyon.

Final designs for the electric distribution system for the project have been completed. All poles have been set for a 3.3-kv. line being constructed by the Newbery Electric Corp., of Los Angeles, and about three miles of cable has been laid on the crossarms, most of which has been sagged. Cables have been placed between the Southern Sierras substation and the transformer substation.

A. B. West, president, The Nevada-California Electric Corp. (in center of picture), throws the switch and thereby delivers 40,000 hp. of electric power for operations at Hoover Dam. In front of the control board at Mr. West's left are E. J. Waugh and C. H. Rhudy, construction engineer and construction superintendent respectively of the Hoover Dam line, ad R. H. Halpenny, electrical engineer of The Southern Sierras Power Co.



These towers on the Hoover Dam 132-kv. power line are 750 ft. apart and cover a total distance of 225 miles. The state line dividing California and Nevada runs through the white strip of desert sand crossed by the towers

Data received by the government from the manufacturers of large turbines as to the turbines they would install at the power plant have been referred to the Southern California Edison Co. and to the City of Los Angeles.

Location of the diversion tunnels for the Hoover Dam were fixed early in July and concrete tests are in progress. Six Companies, Inc., had 1,250 men at work at Boulder City and at its Cape Horn camp on July 15.

Members of a congressional subcommittee on Western reclamation projects and national parks, accompanied by Dr. Ray Lyman Wilbur, Secretary of the Interior; Dr. Elwood Mead, commissioner of reclamation; H. A. Brown of the Reclamation Bureau; Horace M. Albright of the National Park Service, and Northcutt Ely, executive secretary to Dr. Wilbur, visited the project July 3. Members of the congressional subcommittee included: Frank Murphy of Ohio, Edward T. Taylor of Colorado, Burton L. French of Idaho, W. W. Hastings of Oklahoma, Don B. Colton of Utah, Addison T. Smith of Idaho, Robert Luce of Massachusetts and William A. Duval, clerk of the committee.

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Time Extended for Hoover Dam Power Contracts

An extension of four months time in which to ratify Hoover Dam power contracts with the government has been granted Pasadena, Calif., and ten other allottees by Dr. Ray Lyman Wilbur, Secretary of the Interior, according to Harold P. Huls, Pasadena city attorney and chairman of the legal committee of smaller city allottees. Other cities in this group are Burbank, Glendale, Beverly Hills, Fullerton, Anaheim, Newport Beach, Riverside, Colton, Santa Ana and San Bernardino, as originally designated. In the original allocation of power by contract of April 26, 1930, cities in Southern California other than Los Angeles were allocated six per cent of the power to be generated, or 39,000 hp.

Announcement was made by Mr. Huls that Hoover Dam power contracts of the smaller allottee cities may be signed at any time now, but will not be binding unless ratified by a two-thirds vote of the electors of the interested communities on or before Nov. 15, 1931.

In the meantime, the city council of Riverside has decided not to contract for Boulder Dam power. After thoroughly reviewing the situation, members of the city council and members of the board of public utilities came to the conclusion that public sentiment was adverse to the city's contracting to take power from the Boulder Canyon project for a period of 50 years. Editorials published in local newspapers expressed the opinion that the city is amply protected by the private company facilities now available. Riverside is served by The Southern Sierras Power Co.

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EDISON COMPANY FILES NEW RATE SCHEDULE—A new reduced rate schedule for lighting, heating, cooking and water heating service in the San Bernardino mountain area around Lake Arrowhead, Calif., has been filed with the California Railroad Commission by the Southern California Edison Co. Ltd. The new schedule, effective Aug. 9, provides for rates of 10c. per kw.-hr. for the first 7 kw.-hr., 4c. for the next 150 kw.-hr., and 3c. for each above 150 kw.-hr.

Farm Rates Protested by California Grange

Alleging that the rates for electric energy charged agricultural consumers by the Pacific Gas and Electric Co. and the Great Western Power Co. are excessive and not warranted by present economic conditions, the California State Grange, through George Sehlmeyer, master, filed a complaint with the California Railroad Commission June 30. The commission is requested in the complaint to order a reduction of at least 20 per cent in both the demand charge and the energy charge made by the companies for agricultural-power service.

It is stated in the complaint that since the Railroad Commission fixed the present agricultural rates for the two companies mentioned continuous lowering of underground water tables has resulted in increased load densities per mile of distribution line, greater consumption of power per unit of connected load, and decreased unit cost of serving agricultural power consumers. Another reason given for the demand for relief in the matter of power rates is the present financial distress of the companies' agricultural consumers.

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City Attacks P.G. & E. Street Lighting Bid

At a meeting of the board of supervisors of San Francisco on June 22 action was taken with the objective of having the city appear before the California Railroad Commission to seek lower gas and electric rates for street lighting and public institutions. Two resolutions were adopted by the board. One instructed the City Attorney to begin without delay a study of the procedure necessary for the city to follow in making a plea for lower rates before the Railroad Commission. This resolution was referred to the public utilities committee. The second resolution instructed the City Attorney to make a special study of the rates paid by the city's public institutions for gas and electricity, with a view of asking the commission to lower the rates. This resolution was referred to the lighting committee.

These actions followed the opening of the bid of Pacific Gas and Electric Co. for lighting the city's streets and furnishing gas and electricity to public institutions. Representatives of the power company present at the meeting explained that lower rates could not be made for the coming year on account of the water shortage and the probability that the company would have to generate electricity with steam power because of a probable shortage of hydro-electric power.

"City Hall attacks on electric and gas rates at this time can probably be attributed to the political season, rather than to the facts in the case, President A. F. Hockenbeamer of the P.G. & E. Co. said in answer to the city's attack on street lighting rates.

"As to our bid for San Francisco street lighting, we merely quoted the same unit rates that were in effect last year. Whether the city's payments to the company will be increased by $50,000 as alleged, or any other sum, will depend entirely on how much additional lighting may be ordered by the city. This is not within our control. The company made reductions in its street lighting contract in the fiscal year 1928-29 amounting to $7,500 a year. It made further reduction in 1929-30 of $20,600. On March 1, 1930, it further reduced its street lighting rates by $36,000. This means a total reduction of $64,100 a year, compared with the rates paid by the city in 1928.

Answering charges that the policies of the company were now dictated in the East, Mr. Hockenbeamer said:

"The company is managed wholly by Californians from the president down to the office boy. Every decision affecting the company's policies is made at 245 Market St., San Francisco. It is true that the North American Co. of New York is a large stockholder, but its ownership represents only 20 per cent of the total stock of the company. The Standard Gas and Electric Co. of Chicago, also referred to as a large 'Eastern stockholder' owns only a 4 per cent interest in the company."

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San Diego Co. Elects W. F. Raber President

At a meeting of the board of directors of the San Diego Consolidated Gas & Electric Co. held in San Diego, Calif., July 24, W. F. Raber was elected president of the company. Mr. Raber has been vice-president and general manager since 1924.

The office of president has been held by Robert J. Graf, of Chicago, first vice-president of Standard Gas & Electric Co. and Byllesby Engineering & Management Corp.

Lighting Conference Held At Montana College

To help develop more effective use of light for illumination, a conference was held at Montana State College, Bozeman, just prior to the close of the last semester. The college electrical engineering department, under Prof. J. A. Thaler, sponsored the meeting in cooperation with General Electric Co., Westinghouse Lamp Co., Curtis Lighting Inc., and Montana Power Co.

From nineteen cities came 60 delegates, including district, city and sales managers of the power company, electrical contractors, advertising managers, engineers, architects and teachers, and 90 visitors.

Included in the list of speakers were: Dr. A. J. M. Johnson, professor of physics, who reviewed the nature and theories of light; C. F. Bowman, assistant professor of electrical engineering, who demonstrated the effects of glare, shadows and light intensities and showed methods of measuring light and illumination; and Mrs. Olga Ross Hannon, professor of art, who discoursed on the psychological effects of color.

C. E. Spangler, Edison Lamp Works, Denver, gave illustrated lectures on "Store and Window Lighting" and "New Developments in Lighting." An illustrated lecture on "Modern Interior Lighting Practice" by William Foulks, Curtis Lighting Inc., was presented by E. B. Heath, of the college; and A. D. Stewart, Westinghouse Co., Butte, Mont., spoke on "Design of Lighting Installations" and "The Importance of Using Standard Practice."

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Arizona Women's Committee

UNDER the leadership of Miss Gladys B. Price, director of the home service department of the Central Arizona Light & Power Co., Phoenix, a women's committee organized last December in that company is doing important work in the furtherance of the power company's public relations program.

Electrical refrigeration was featured at a recent monthly meeting of the committee. R. A. Best, sales manager of the Central Arizona company, spoke to the women on "Why Electric Refrigeration?" His talk was followed by a motion picture, "General Electric Pays for Itself," after which R. J. Morrissey, one of the company's salesmen, explained the principles of the General Electric refrigerator's operation. The photograph above was taken at a recent meeting of the committee.

Company to Be Repaid for Klamath Development

A bill appropriating $250,000 to reimburse the Electro-Metals Co., San Francisco, for its expenditures in the development of an electro-metallurgical enterprise on the Lower Klamath River has been signed by the Governor of California. The company had filed a claim for $344,000, which covered an amount only sufficient to place it in the same position that it would have been had it not engaged in the project.

The enterprise in question contemplated the erection of a power plant, the development of 100,000 kw. to be used in the making of aluminum, and a factory to be built at Trinidad. From 1909 to 1924 the Electro Metals Co. had invested large sums of money in necessary research, investigation and development of the project and had acquired both from the State of California and from the United States the necessary water rights. In 1924 the Klamath River Fish and Game District Act, sponsored by the California Fish & Game Commission, was passed, making it unlawful to erect any dam or other obstruction in the Klamath River between its confluence with the Shasta River and its mouth. Since that time, the company, hoping for repeal of the act, has preserved its rights in good standing.

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Edison Company's System Sought by Tulare

On July 1 the city council of Tulare, Calif., authorized its board of public utilities to negotiate with the Southern California Edison Co. Ltd., for the acquisition of the company's distributing system in Tulare. Recommendation that the city endeavor to purchase the system was made to the council by its public utilities committee. Valuation of the Edison company's distributing system was said by the committee to be approximately $238,000.

Plans of the council call for the purchase of power at wholesale from the Edison company in the event Tulare voters sanction the purchase of the distributing system and vote the necessary bonds. The total saving to the city, the council said, would be approximately $100,000 a year. In view of the fact that the total bills of all consumers of the Southern California Edison Co. Ltd. within the proposed district for the year 1930 amounted to $170,000, this estimate of a saving of approximately $100,000 a year would seem to be high, and to indicate the desirability of further investigation on the part of the city council.

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Utility Franchises to Stand in San Diego

San Diego's city council by a vote of 4 to 1 rescinded its action calling for an election designed to terminate by 1935 all franchises existing at this time. The action involved San Diego Consolidated Gas & Electric Co., Southern California Telephone Co. and San Diego Electric Railway Co.

Action was first taken by the council because a new charter, to become effective Jan. 1, 1932, contains franchise provisions at variance with existing laws, notably a clause that franchises can be terminated only at ten-year intervals by suitable condemnation proceedings, whereas at present they may be terminated by vote of the people. The council felt that this right was being taken away from the people and intended to amend the charter forthwith.

However, upon assurance by the utilities that they would voluntarily submit to continuation of the repeal sections if it is determined that the new charter affects existing franchises, the action was dropped.

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Pacific Northwest Co. Personnel Changes

Coincident with the arrival at Portland July 1 of Carlton B. Short to assume the general managership of the railway department of the Pacific Northwest Public Service Co., other personnel and functional changes in that company and its subsidiary, Portland General Electric Co., were announced by Franklin T. Griffith, president.

William H. Lines, vice-president of both companies and for several years manager of the railway department, was appointed treasurer of both companies and given broader responsibilities in both. W. S. McCullough, vice-president and treasurer, Central Public Service Corp., Chicago, the holding company for the Portland comany, and Ray E. Brennan, general auditor of the Portland company, were appointed assistant treasurers of the two companies. Casius R. Peck of the legal department in Portland, was appointed secretary of both companies, succeeding R. W. Shepherd, resigned. Clarence D. Phillips, also of the legal department, became assistant secretary.

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P. G. and E. Co. Advertisement Wins Award

JOBS
because the
P·G·and E· "Buys at Home"
Pacific Gas and Electric Company's 1930 construction program is going full speed ahead.
It represents an investment of $45,000,000.
We are keeping this money home wherever possible by employing local labor and buying from local manufacturers.
Scores of factories in the San Francisco Bay area are running full crews because the P. G. and E. buys at home. A few of them speak for themselves in this advertisement.
Buying at home is merely common sense. It builds up home payrolls, promotes community growth and prosperity—it makes better business conditions for everybody.
When we buy at home we are helping ourselves. We are spending our money with firms that buy electric power and natural gas from us. We are creating jobs for hundreds of workers who will want P. G. and E. service in their homes.
More workers, more business—and more buying power.
It's an endless chain of progress—by it men prosper and cities grow.
PACIFIC GAS AND ELECTRIC COMPANY
P·G·and E·
Owned-Operated-Managed by Californians
Joshua Hendy Iron Works San Francisco
P. G. and E. orders for the past months have been the "backbone" of our existence during trying times, enabling us to carry on with a normal shop organization.
P. J. BENNIMAN Manager.
The Steel Tank and Pipe Company—Berkeley
For the past ten years we have enjoyed steady growth which has been materially helped by work turned over to us by the P. G. and E.
GEORGE A. RAITT, Vice-President.
Stuiger & Kerr Stove and Foundry Co. San Francisco
Orders from the P. G. and E. absorb 50 per cent of our plant capacity. This makes for steady and lucrative employment for 105 mechanics.
ANDREW KERR, President.
Yates-Holett Paint Co. San Francisco
We appreciate your recent orders for paint.
The P. G. and E. is entitled to the grateful acknowledgment of all local manufacturers for its part in helping to maintain good business conditions.
JAMES G. YATES, General Manager.
Western Pipe and Steel Company San Francisco
Our South San Francisco plant is operating to capacity, employing 930 men. The business we have received from you is largely responsible for this condition.
H. G. TALLIERSAY, Executive Vice-President.
The Pelton Water Wheel Co., Inc.
We have orders on our books from your company amounting to over four hundred thousand dollars. During a period of general depression such as this country is now experiencing, work of this magnitude materially assists us to retain a large percentage of our employees on the payroll.
California Steel Company Oakland
We wish to thank you for the contract for your Newark substation, as well as other work over a period of years.
If more companies would support local industries as your company does, there would be less business depression at this time.
CHARLES E. SPENSER, Vice President and Manager.
National Mill and Lumber Company—San Francisco
We have just been awarded the contract for supplying your company with cross arms and other timber materials for the coming year. Your contract is very much appreciated.
We particularly wish to commend your policy of placing business with local manufacturers—it benefits not only individual manufacturers but the Bay Cities as a whole.
JAMES TUCEK, President.
Westinghouse Electric & Manufacturing Company San Francisco
Your large insulator order will be filled in one of our local plants, where we are now employing three hundred people in manufacturing work alone.
While our local plants sell all over the Pacific Coast, a substantial percentage of our output is purchased by your company. This has materially helped us to keep our production nearly up to normal these past few months; the new order will make it possible for us to maintain this condition for some time to come.
W. P. LYBRAND, San Francisco Manager.

This advertisement published by the Pacific Gas and Electric Co. in the San Francisco Bay area newspapers in August, 1930, won the first of 36 awards made by the Public Utilities Advertising Assn. at its meeting June 17 in New York

Temporary Veto Given Idaho Energy Tax

After a hearing before three judges in the federal court at Boise, Idaho, the court issued a temporary injunction July 3 against the attorney general of Idaho and the commissioner of law enforcement to prevent them from collecting the kilowatt-hour tax against the Utah Power & Light Co. enacted at the last session of the Idaho Legislature. In closing the hearing, the court indicated that its decision in the matter will be rendered about Sept. 1, on a motion of the state of Idaho to dismiss the action. The state secured permission, in case of a decision against the law, to re-open the case for introduction of evidence.

The Utah Power & Light Co. was required to post a $30,000 bond to insure the state against loss. Both sides have indicated preparations to take the case to the United States Supreme Court.

The power company assailed the law on several constitutional grounds and submitted affidavits tending to show the tax applied to a commodity which went instantly into interstate commerce and for that reason was out of the state's tax range.

The state contended the power was developed from a resource within the state and was thus taxable. Counter affidavits were submitted.

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N.E.L.A. 1931 HANDBOOK PUBLISHED—The 1931 edition of the N.E.L.A. Handbook and the bound edition, "The Electric Light and Power Industry in the United States," have just been published by the National Electric Light Association. The books contain 188 pages profusely illustrated with photographs, charts, diagrams and statistical tables, and make available a detailed account of every phase of the electrical industry from its beginnning. Subjects covered include the utilization of electricity in industry, the office, the home and on the farm; financing and investment; holding and management companies; steam and water power development; government ownership; public utlity regulation, taxes, rates, service, future development, etc.; cost of manufacture and ultimate delivery of electricity; radio broadcasting; visual education; and many other subjects, including transportation and the gas industry. One entire chapter is given over to statistics of the industry and an eight-page bibliography covers completely the more important literature on the subjects of electricity and the electrical industry. Copies may be obtained from the N.E.L.A., 420 Lexington Ave., New York City. Prices, $1.75 for single copies; $1.50 each, ten or more copies. The loose leaf edition of the handbook is available at $2.50 per copy complete with binder.

Utility's Advertising Takes First Prize

Advertising of the Los Angeles Gas and Electric Corp. was awarded the first prize trophy in the public utility classification at the recent convention of the Pacific Advertising Clubs Assn. held in Long Beach. The trophy was a silver cup, suitably inscribed. The advertising was in competition with that of other utilities on the entire Pacific Coast, and included both gas and electric newspaper advertising, direct advertising, house organs and year book.

This is the third first prize award the Los Angeles Gas and Electric Corp. has won in the five years the company has entered a display in the Pacific Advertising Clubs Assn. contest.

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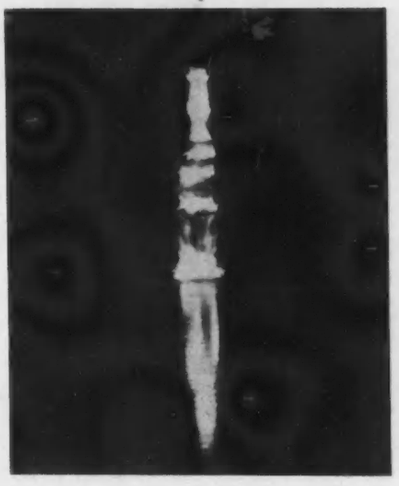
Falls in Park Lighted



Rainbow Falls in Golden Gate Park, San Francisco, hereafter will not be turned off at sundown, but will have added beauty after dark since the installation of this illumination by the Pacific Gas and Electric Co.

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COAST COUNTIES CO. EXTENDING RURAL SERVICE—The Coast Counties Gas and Electric Co., Santa Cruz, Calif., will supply the Bonny Doon area with 2.3-kv. single-phase electric service during the current month. The cost of the project is estimated at between $35,000 and $40,000, which includes purchase of 6½ mi. of 22-kv. transmission line from the Pacific Gas and Electric Co., construction of 13,500 ft. of primary distribution circuit along Ocean View Road, building a 22- to 2.3-kv. circuit, and the construction of 6,000 ft. of 22-kv. line in the vicinity of the Davenport cement plant. A pole-top substation will be erected to cut the voltage from 22 to 2.3 kv. A 50-kva. transformer and a 17-kva. voltage regulator on the pole platform will supply the territory with 2.3-kv. single-phase service.

Leased Property Taxable In California

The State Board of Equalization of California in a ruling made late in June refused to recognize a complete exemption from local taxation of property leased to public utilities for operative purposes. The decision was made in the matter of the claim of eleven public utliities that there was no interest in leased property used for operative purposes assessable locally. This claim was made following the decision of the California Sureme Court in the case of Morgan Adams, Inc., vs. Los Angeles County (209 Cal. 696), that the county must return to Morgan Adams, Inc. taxes collected on a building leased to the Southern California Telephone Co. The utilities filed reports with the State Board of Equalization asking that property rented by them be entirely relieved from local taxation. The assessor of Los Angeles County, and a number of other county assessors felt that the companies were putting an erroneous construction on the language of the court in the case mentioned and protested the classification of all such property as operative. They urged the Board of Equalization to declare the landlords' interest in the leased property could still be taxed locally, declaring that otherwise large revenue losses to cities and counties throughout the state would result.

After consolidated hearing before the board the members came to the conclusion that the position of the assessors was correct and that in each instance there remains an estate in the property assessable to the owner for local taxation. For lack of a better term this estate has been called a "reversionary interest." Its valuation is to be fixed by the county assessor in common with other non-operative property and naturally would fluctuate according to the terms of the lease and other special conditions.

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SPOKANE VICTIM OF BOGUS ENGINEER—A warning has been issued from Spokane relative to the operations of a man calling himself Richard Kimball and styling himself chief engineer in charge of survey work for the "American Light and Power Co., of Chicago." Mr. Kimball arrived in Spokane and announced that he was opening offices there for the American Light and Power Co., of which he would be in charge, the announcement stating that as chief engineer he would be in charge of survey work for the company's project, the nature of which had not been divulged, and that five survey parties would soon be put into the field. He also announced that two airplanes with photographers to aid in the work would arrive shortly. Charles J. Miller, Charles J. Miller, Jr., and C. W. Howard, of Chicago, were the "owners" of the American Light and Power Co., according to Mr. Kimball. Very shortly thereafter Mr. Kimball hastily left Spokane after having passed a number of worthless checks.

Edison Company Compares Rainfall Figures

Because there has been some concern as to water supply in California during the present season, the Southern California Edison Company Ltd. has prepared a comparison of conditions as they existed on May 15 this year and on a similar date in 1924—the year of least rainfall since records have been kept in California. The comparative figures follow:

Station	Comparative Precipitation Data May 15, 1931	May 15, 1924
Santa Ana River No. 1	20.71	20.23
Mill Creek No. 3	17.48	18.09
Lytle Creek	24.73	19.90
Ontario	23.57	20.53
Azusa	15.82	11.96
Kern River No. 3	6.64	3.55
Kaweah No. 3	15.08	11.15
Huntington Lake	17.19	14.43
Big Creek No. 1	17.07	15.86
Big Creek No. 2	15.39	14.92
Big Creek No. 3	13.39	11.41

During the past few years the Edison company's policy has been to supply additional generating capacity as steam, instead of hydro. As of July 1, 1924, this company's ratio of steam to hydro capacity was 1 to 2.97, while at the present time this ratio is 1 to 1.035. While it is true that the cost per kilowatt-hour output is higher in a dry year than in a wet year, the increase will not be as large as was the case during 1924 because since that time the cost of fuel oil has decreased 35 per cent and the efficiency of the steam plants has more than doubled. Since fuel cost is a large part of the cost of steam plant operation, this is an important factor in total cost of power. The labor cost per kilowatt of capacity has been reduced to about one-half that of 1924.

Under run-off conditions similar to those of 1924, the Edison company can carry all of its load requirements with the water available and by operating only its Long Beach Nos. 2 and 3 plants as a source of steam power, not calling upon the operation of the standby plants at Long Beach, Redondo Beach, and Visalia. The run-off from the high elevation watershed has now progressed to a stage where it is definitely known that the total run-off will not be less than it was in 1924, and present indications are that the 1924 run-off will be exceeded by about 10 or 15 per cent.

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POMONA (WASH.) GRANGE PLANNING POWER PLANT—Based on provisions of the District Power Bill approved by voters of Washington at the last general election, the Pomona Grange is completing plans for a power plant just south of the Skagit-Snohomish line, to develop 7,500 hp. The project includes storing 67,000 acre-ft. of water in Lake Cavanaugh in southeastern Skagit County. The Grange, under the name of the Skagit County Irrigation & Power Co., has applied to the Department of Hydraulics, at Olympia, for a permit to divert the water from Deer Creek into the lake.

Colorado Springs to Extend Service.

The city of Colorado Springs has been authorized by the Colorado Public Utilities Commission to make material extensions in the territory served by its municipally-owned light plant.

Under the projected expansion plans the transmission line between Manitou and Cascade (previously owned by the Cascade Public Service Co.) will be extended from Cascade to Green Mountain Falls and the north slope of Pike's Peak. The system will furnish wholesale electric power to the Cascade Town Co. for local distribution, and electricity to be distributed at Green Mountain Falls, Chipeta Park and surrounding territory.

The city a short time ago acquired the generating and distribution plant, as well as the land on Pike's Peak, from the Empire Water and Power Company.

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Electrical Workers' Pay Cut in Northwest

In line with wage and salary reductions recently put into effect in the Pacific Northwest Public Service Company, and its subsidiary, Portland General Electric Company, Portland, a 7½ per cent reduction from the present scale of wages for the electrical workers was ordered July 1. Wages in this classification are fixed by agreement with the local union, and the new agreement on reductions was refereed by O. L. Price of the *Morning Oregonian*. The company had asked for a 10 per cent reduction.

Mr. Price in his decision said that a 7½ per cent reduction would place the workers in this classification on an equal basis with their fellow employees. General office employees took a 10 per cent reduction in salaries on May 1, and street railway employees covered by union agreement, took a 7½ per cent reduction as of the same date through arbitration completed May 20.

News Shorts

¶ EXECUTIVES OF the Southern California Edison Co. Ltd. are studying the progress being made with the mercury-vapor turbine being developed by the General Electric Co. at Schenectady, N.Y., with the view of adopting this type of generating equipment for the next 133,000-hp. unit to be installed at the Edison company's Long Beach steam-electric generating station. Announcement of the company's consideration of the mercury turbine equipment was made June 8 by Fred B. Lewis, vice-president and assistant general manager of the Edison company at Los Angeles.

¶ THE FIRST SIX MONTHS of 1931 show an increase in the number of Red Seal homes constructed in the Vancouver district over the same period last year, according to R. Hall, acting secretary of the Electrical Service League of British Columbia. This year 176 residences and 12 apartment blocks were granted the coveted Red Seal certificate by the Service League, while in 1930 the figures were 135 residences and 10 apartments.

¶ FIRE, ORIGIN UNKNOWN, destroyed The California Oregon Power Company's Stayton (Ore.) generating plant recently. The plant was used in distribution throughout central Willamette Valley. Insurance covered the $16,000 loss.

¶ FORMAL INVESTIGATION of the The California Oregon Power Company and the Mountain States Power Company rates, charges, regulations, and practices has been ordered by C. M. Thomas, Oregon public utilities commissioner. No hearing date has been set.

¶ WORK ON A $1,000,000 TRANSMISSION LINE from the Wenatchee development (Rock Island project) to Beverly Park, Wash., has been started by the Puget Sound Power & Light Company. Approximately $200,000 will be spent this year.

¶ WEST COAST POWER COMPANY, Shelton Wash., through M. V. Watson, general manager, announces a 13 to 30 per cent reduction in commercial lighting, depending upon the "ready to serve" rating of consumers.

¶ COMPLETION OF THE PROSPECT hydro-electric project on the Rogue River in southern Oregon is being planned by The California Oregon Power Company.

¶ KINGS RIVER BASIN (Calif.) power resources will be studied by the U. S. Geological Survey.

¶ APPLICATION HAS BEEN FILED by The California Oregon Power Company with the California Division of Water Resources for permission to divert 3,000 sec.-ft. of water from the Klamath River for the purpose of developing power amounting to 54,545 hp. at an estimated cost of $4,500,000. Recent Oregon legislation placed unsurmountable difficulties in the way of Copco's obtaining a site for this development on the Oregon side of the Klamath.

¶ BID CALL for assembling and installing hydro-electric machinery in Seattle's Diablo power plant has been rescinded by the city's Board of Public Works, *sine die*. Diablo costs are estimated at between $200,000 and $300,000. Apparatus included two 66,700-kva. main generators, two 1,500-kva. house generators, four water wheels, two 14-ft. butterfly valves, and auxiliary equipment.

¶ MINOR-PART LICENSES to traverse public lands were granted recently by the Federal Power Commission to the Montana Power Company for a light and power line serving Absarokee, Mont., and to The California Oregon Power Company for a line serving Sprague River, Ore.

¶ MCKENZIE RIVER (Ore.) basin's total potential water supply without storage is 290,000 hp. for 90 per cent of the time and 444,000 hp. for 50 per cent of the time, Geological Survey Water-Supply Paper 637-C shows. The paper, describing the water-power resources and the geology of the principal dam sites of the basin, indicates further that with storage at four proposed reservoir sites, the potential power for 90 per cent of the time would be increased to 325,000 hp.

¶ SANTA CLARA COUNTY (Calif.) prune growers and other electric consumers in the vicinity of Saratoga, Cupertino, Los Gatos, Santa Clara, San Jose, and other towns have filed a complaint against Pacific Gas and Electric Company, alleging present rates for electric energy for agricultural purposes out of line with decreases in money, labor, material, and supply costs.

Tahoe Tavern — soon to be the workshop and playground for Western electrical engineers

A. I. E. E.

Full Meeting Expected At Tahoe in August

If the indices of inquiries and reservations for the A.I.E.E. convention at Lake Tahoe, Aug. 25-28, bear any relation to the actual attendance, the problems of the Institute and the electrical industry will have ample talent employed in their solution. The backbone of the discussion will have its basis in a technical program arranged by a committee under the direction of General Convention Chairman A. W. Copley, of the Westinghouse Co., who was recently elected to a vice-presidency of the Institute.

Entertainment, arranged by a committee under A. G. Jones of the General Electric Co., has features which will be novel even to the most inveterate conventioneer. Golf competitions, scenic trips, a barbecue supper, and "A Night in Monterey" will offer the recreation and social relaxation necessary to make the gathering a complete success.

All the elements for an ideal vacation and an enlightening insight into electrical progress have been combined into the four-day program, the committee in charge advises.

P. C. E. A.

Air Conditioning Committee Formed

An air conditioning committee has been organized in the Pacific Coast Electrical Assn. to function under the Merchandising Bureau, Commercial Section. J. W. Wrenn, of the Pacific Gas and Electric Co., San Francisco, is chairman.

An important function of the committee will be the preparation of a manual which will contain sufficient information to enable power company salesmen to interest prospective purchasers of air conditioning equipment, such prospects to be referred to the manufacturers for the necessary apparatus.

The manual will treat of (1) buildings of the future, and (2) air conditioning in whole and in part. Under the second heading articles will appear descriptive of apparatus to be used under all conditions. These articles will be supplied by members of the committee, each of whom will write on that part of the work with which he is most familiar. Members have been instructed to consider only conditions in California, Nevada, Arizona, Territory of Hawaii and the Philippine Islands when preparing articles.

The first meeting of the committee was held July 23, 1931.

Convention Lighting Committee

Responsible, with Vincent Duffy, for the interior and exterior lighting effects at the P.C.E.A. Del Monte convention in June were (left to right) W. P. Bear, lighting committee chairman, Pacific Gas and Electric Co.; Walter Carleson, Edison Lamp Works; Clark Baker, illuminating engineer; William Wuelker, Wuelker Reflector Lighting Corp.; and Pierre Vinet, commercial manager, Coast Counties Gas & Electric Co. Venetian Nights Festival, one of the night programs, boasted one of the most imposing lighting spectacles seen on the Coast

Change in Purchasing-Stores Chairman

G. M. Richardson, of the Southern California Edison Co. Ltd., who, it was announced in the July 1 issue of ELECTRICAL WEST, would serve as chairman of the Purchasing and Stores Section, P.C.E.A., for the coming year, has failed to accept the chairmanship. In his stead, A. A. Charonnat, of the Pacific Gas and Electric Co., San Francisco, has been appointed chairman of the section.

Mr. Richardson was unable to assume the chairmanship on account of his recent election as president of the National Association of Purchasing Agents.

Northwest Association

Officers Elected for Association Year

Officers of the Northwest Electric Light and Power Assn. for the coming year were elected at the twenty-fourth annual meeting of the association held in Portland July 10 as follows: president, P. M. Parry, Utah Power & Light Co., Salt Lake City; vice-president, J. E. E. Royer, The Washington Water Power Co., Spokane; vice-president for Idaho, R. B. King, Idaho Power Co., Boise; vice-president for Montana, J. C. Ryan, Montana Power Co., Butte; vice-president for Oregon, L. T. Merwin, Northwestern Electric Co., Portland; vice-president for Utah, George M. Gadsby, Utah Power & Light Co., Salt Lake City; vice-president for Washington, L. R. Coffin, Puget Sound Power & Light Co., Seattle.

The following members-at-large of the executive committee were elected: representing the utilities, A. C. McMicken, Portland General Electric Co., Portland; representing the jobbers, J. I. Colwell, Graybar Electric Co., Seattle; representing the utilities (to fill out the unexpired term of Mr. Royer), H. J. Flagg, Grays Harbor Railway & Light Co., Aberdeen, Wash.

Appointments thus far made by President Parry include the following section chairmen: Acounting, W. F. Miller, The Washington Water Power Co., Spokane; Commercial, R. U. Muffley, Puget Sound Power & Light Co., Seattle; Engineering, E. H. Collins, The Washington Water Power Co., Spokane; Public Relations, Adam S. Bennion, Utah Power & Light Co., Salt Lake City. Berkeley Snow, ELECTRICAL WEST, Portland, has been reappointed secretary, and R. H. Jones, Utah Power & Light Co., Salt Lake City, treasurer.

Elections were held on the same day as the finals in the association public speaking contests and in the evening a dinner was held for the delegates to the meeting and the public speaking committee.

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Public Speaking Contest Winners Announced

The Portland General Electric Co. walked off with both prizes in the public speaking contest of the Northwest Electric Light and Power Assn. held July 10 at Portland. James Huber, a range salesman, won first prize in the men's division and Dorothy Scherfen, stenographer at Station L, took first in the women's division. The prize in each case was $100.

The public speaking contest of the Northwest association for the past year was conducted separately from the national contest. Employees were invited to prepare three- to five-minute talks on "The Contribution of Electrical Service to the American Home." Five companies having 3,780 eligible employees took part in both the men's and women's divisions and there were a total of 150 participants or 4.7 per cent of those eligible. A greater participation was recorded among eligible women employees than among men.

In the men's contest, second prize of $75 was won by Gordon C. Lynch, The Washington Water Power Co., Spokane, while R. S. Siegenthaler, Northwestern Electric Co., Portland, took the third prize of $50. In the women's contest second and third prizes respectively went to Viola Templeton, The California Oregon Power Co., Medford, and Grace Komis, Northwestern Electric Co., Portland. Similar prizes were awarded in this division. Contests were conducted by the public speaking committee headed by Geo. L. Myers, Pacific Power & Light Co., chairman.

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Meetings

Coming Events

American Institute of Electrical Engineers—Annual Pacific Coast Convention, Lake Tahoe, Calif., Aug. 25-28, 1931.

International Association of Electrical Inspectors, Northwest Section—Sixth annual convention at Salem, Ore., Oct. 5-7, 1931.

Southwest Section—Annual convention at San Francisco, Sept. 28-Oct. 1, 1931.

National Electric Light Association—Rocky Mountain Division—Annual convention at Stanley Hotel, Estes Park, Colo., Sept. 2-4, 1931.

National Electrical Wholesalers Association, Pacific Division—Thrice yearly meeting, Hotel Del Monte, Del Monte, Calif., Oct. 8-10, 1931.

Notable Golf Played at Portland Club Meet

Stellar golf marked the tournament of the Portland Electric Club held at the Mount Hood golf course last month and participated in by 57 members and guests. The grand prize, consisting of the Portland Electric Club cup for low-net went to Gene Knight, E. L. Knight Electric Co., while sundry prizes donated by jobbers and manufacturers were distributed to runners-up, long drivers, fancy approachers and accurate putters. Winners of the nine major prizes distributed for the various events were: Jack Gilham, Portland General Electric Co.; Ben Huenergard, Huenergard Electric Co.; John Plankinton, Northwestern Electric Co.; J. B. Kilmore, Pacific Power & Light Co.; L. F. Busse, Crouse Hinds Co.; R. P. Tynan, Fobes Supply Co.; Ed Hall, General Electric Co.; George Barker, General Electric Co.; and W. R. Grasle, E. L. Knight Electric Co.

Prizes were awarded at the regular club meeting following the tournament by Ben Huenergard, chairman of the golf committee. At the same meeting R. C. Kenney, past president of the club, awarded a fabulous trophy of unknown make and origin to John Plankinton for a feat that seems destined to remain clouded in mystery if one is expected to rely on the presentation speech for an inkling as to what the prize was for.

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CANADIANS MEET AT BANFF—This year's annual convention of the Canadian Electrical Assn. was held at the Banff Springs Hotel, Alberta, from June 16-18, thus coming West for the first time. Among the delegates from Vancouver were E. H. Adams and J. I. Newell, vice-presidents of the B. C. Electric Railway Co.; A. Vilstrup, assistant plant manager, E. E. Walker, sales engineer, R. Jenkinson, of the electrical engineering department, and R. Hall of the light and power department of the company. George R. Atchinson, of the Southern Canada Power Co., Ltd., Montreal, Que., was re-elected president of the association for the ensuing year.

UTAH ENGINEERS IN ANNUAL MEETING—At the annual meeting of the Utah Society of Engineers, held at the Old Mill Club in Salt Lake City on the evening of June 25, Dr. Dorsey Alfred Lyon, director of the Utah engineering experiment station of the University of Utah, was elected president for the ensuing year. Other officers elected to serve with him were C. C. Pratt, first vice-president; Fred Richardson, second vice-president; Ralf R. Woolley, secretary; R. K. Brown, treasurer; and T. C. Adams and N. C. Goodrich, retiring president, members of the executive committee. Mr. Wooley and Mr. Brown were re-elected.

THE ELECTRIC CLUB OF SEATTLE will suspend summer meetings until Sept. 14, J. J. Hayes, president, has advised its members.

Personals

New Coast Merchandise Manager for Westinghouse

GEORGE BAILY, for the past three and a half years Pacific Coast merchandising manager for the Westinghouse Electric & Mfg. Co., with headquarters in San Francisco, has been assigned the duties of assistant sales manager at the headquarters of the Westinghouse merchandising department at Mansfield, Ohio. Prior to his coming to San Francisco, Mr. Baily had been assistant to the general manager of the merchandising department in Mansfield.

C. A. Meier, who has been district manager in charge of merchandising for the Southwest and Rocky Mountain regions, with headquarters in St. Louis, has been appointed to succeed Mr. Baily as regional manager of the merchandising division in the Pacific Coast District. Mr. Meier has been associated with the Westinghouse company for the past twenty years.

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COL. ALBERT E. PIERCE, president, Central Public Service Corporation, Chicago, visited Portland early in July to inspect the Pacific Northwest Public Service Co. and Portland General Electric Co., subsidiaries of Central Public Service. At a luncheon in Portland July 7, tendered to about 100 business and professional men of the city by Franklin T. Griffith, president Pacific Northwest company, Mr. Pierce explained the relationship of the holding company to the operating properties and stated that it was the policy of his company to give financial aid and suggestions only to the operating companies, leaving the management of these companies to the local officers. Mr. Griffith outlined briefly some of the problems of utility finance and operation, touching on the effect of taxes and the cost of capital on rates.

CHARLES C. MOORE, for about 30 years president of C. C. Moore & Co. Engineers, Inc., San Francisco, has retired from active participation in the management of the business and has become chairman of the board. Elgin Stoddard, who has been vice-president for about 25 years, succeeds Mr. Moore as president of the company.

E. J. MEHREN, vice-president, McGraw-Hill Publishing Co., Inc., New York, has resigned from that company to assume the presidency of the Portland Cement Association. Mr. Mehren has been associated with the McGraw-Hill company for 22 years, and for the past few years had been in charge of the company's activities in Chicago.

GEORGE BAILY

C. A. MEIER

LESLIE R. COFFIN

CHARLES H. RANDALL, regarded in Los Angeles, Calif., as a leader of advocates of municipal ownership and operation of power projects, has been elected president of the Los Angeles city council for a two-year term. Mr. Randall, a former representative of California in congress, was elected to the council leadership by a majority of one vote over Carl I. Jacobson. The council's water and power committee, named by Mr. Randall, is composed of Thomas F. Ford, James M. Hyde and Mr. Randall. The public utilities committee membership includes Mr. Jacobson, Roy L. Donley and Clarence E. Coe.

HAROLD K. FOX, chief construction engineer, San Joaquin Light & Power Corp., Fresno, Calif., addressed the 20-30 Club at the Hotel Fresno on June 30. Mr. Fox explained to his audience why steam power generation is replacing hyro-electric development in California.

LEONARD FRYER, service manager for the Graybar Electric Co., San Francisco, returned to that city during the early part of July from a two weeks' trip made in connection with transferring the management of the company's Salt Lake City branch from the Denver office to the San Francisco office.

AL G. LINDBERG, for seven years associated with the Watts Electric Co., at 608 Second Ave., Seattle, has established the Lindberg Electric Co. at 108 Cherry St., where he will engage in the electrical contractor-dealer business. The firm will carry a line of radios.

A. W. COPLEY, Pacific Coast engineering manager of the Westinghouse Electric & Manufacturing Co., has been elected a vice-president of the American Institute of Electrical Engineers, New York.

T. H. MORGAN, assistant professor of electrical engineering at Stanford University, has accepted the position of professor of electrical engineering at Worcester Polytechnic Institute.

L. R. Coffin Has Swift Rise to Vice-presidency

LESLIE R. COFFIN, whose appointment as vice-president in charge of operations of the Puget Sound Power & Light Co. was recently announced, was manager for the Stone & Webster properties in Bellingham, Wash., for several years. In 1917 he went to the Hog Island shipyards at Philadelphia, remaining in charge of construction until 1919. From that date until 1924 he served as assistant Pacific Coast manager of Stone & Webster. From 1925 to 1930 he was manager of the eastern Washington district of the Puget Sound company, with headquarters at Wenatchee. In the summer of 1930 he became manager of the central district in Seattle, succeeding R. M. Boykin, who at that time joined the Electric Bond & Share Co. in New York.

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E. A. OLSEN, vice-president of Pacific Public Service Company, San Francisco, and its subsidiaries, recently announced his resignation from this Standard Oil Company subsidiary to take over the executive management of the Oklahoma Natural Gas Company, with headquarters in Tulsa. Mr. Olsen has been an outstanding figure in Western public utility operations since the independent Coast Counties Gas & Electric Company passed into the hands of Standard Oil Company of California two years ago. Coast Counties Gas & Electric Company was at that time controlled by A. E. Fitkin & Company, with which organization Mr. Olsen came to California when Fitkin purchased the system from S. Waldo Coleman and subsequently organized Pacific Public Service Company. Previous to this he was associated in an engineering capacity with various North American owned public utility companies in the East, and had managed utilities in Georgia and Florida for the Insull interests.

J. B. BLACK, of New York, vice-president of the North American Co. of that city and a director of the Pacific Gas and Electric Co., San Francisco, was a visitor in California during July.

W. M. BIRD

C. C. CURTIS

J. L. ALEXANDER

Managers Take Over Puget Sound Districts

ALLOCATION of responsibility for operations of the Puget Sound Power & Light Co. among the three divisions recently established by J. F. McLaughlin, president, is being effected following the arrival in the Northwest of three managers to head these divisions. Each of these division managers is a former officer of a Stone & Webster Co. subsidiary in the East.

J. L. Alexander, division manager in the central district of the Puget Sound company, comprising Seattle and most of King County, has been president of the Houston (Texas) Electric Company, Galveston-Houston Electric Railway Co. and the Galveston-Houston Electric Co. since 1925. Born in Eastport, Me., in 1883, he graduated from the University of Maine in 1906, when he became chief engineer of the Ponce Railway & Light Co., Ponce, P. R. Returning to the United States two years later, he was made superintendent of the St. Croix power station of the Minneapolis General Electric Co. at St. Croix Falls, Wis., remaining there for one year.

Between 1909 and 1925, when he went to Houston, Mr. Alexander was successively superintendent of lighting for the Houghton County (Mich.) Electric Light Co., Savanah (Ga.) Electric Co., and El Paso (Texas) Electric Railway Co., then manager of the Keokuk (Ia.) Electric Co., and later of the Haverhill (Mass.) Gas & Light Co.

Claude C. Curtis, division manager in charge of operations in the western, southwestern and southern districts, was born at Battle Creek, Mich., graduating from the University of Michigan in 1907. He immediately became associated with Stone & Webster and engaged in power station construction for one year. For the next five years he was with the Ponce Railway & Light Co., Ponce, P. R., as assistant superintendent of light and power, superintendent, general superintendent, and manager. For a short time he was secretary to Russell Robb and Henry G. Bradlee at the Boston offices.

Later connections of Mr. Curtis were with the Lake Ariguanabo Co., San Antonio de los Banos, Cuba; the Houghton County Electric Light Co., Calumet, Mich.; and the El Paso Electric Railway Co. From 1918 to 1923 he was manager of the Cape Breton Electric Co., Ltd., Sydney, N. S.; from 1923 to 1931 he was vice-president and manager of the Fall River (Mass.) Gas Works, leaving there to accept his present position in Seattle.

W. M. Bird, who has relinquished the presidency of the Cape Breton, (N.S.) Electric Co. to take up the duties of division manager in the Puget Sound company's northern district, is a native of Newton, Mass. In 1909, after the completion of a college course, he entered the employ of the Oliver Iron Mining Co. of Minnesota. A year later he adopted public utility business as his life vocation, beginning with the operation of a street car in Jacksonville, Fla. Since that time he has been connected with public utilities in Houston, Dallas, and Forth Worth, Texas; Tampa and Jacksonville, Fla.; Savannah, Ga.; Paducah, Ky.; Keokuk, Ia., Port Madison, Wash., and in the maritime provinces of Canada. His experience has included light and power, gas, bus transportation, and street railway, steam heating and ferry operations.

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A. L. LINDEMANN, vice-president and general manager of A. J. Lindemann & Hoverson Co., Milwaukee, Wis., manufacturer of electric ranges, water heaters and table appliances, returned to Milwaukee last month after paying his annual visit to Pacific Coast representatives of the company. Mr. Lindemann spent approximately one month in this territory.

HAROLD H. CLARK, vice-president and assistant secretary of the Pacific Division of Link-Belt Co., with headquarters in San Francisco, has retired from that company after thirty years of service with it. Ralph M. Hoffman, for eight years manager of the Seattle office, has been appointed to succeed Mr. Clark as vice-president and assistant secretary of the Pacific Division.

A. T. KUNZ, superintendent of the customers' service department, El Paso (Tex.) Electric Co., has been reappointed as chairman of the Community Chest publicity committee in El Paso for the current year.

MRS. MARY STEELE, El Paso Electric Co., winner of second prize for the Southwestern Geographic Division in the employees' speaking contest conducted by the N.E.L.A., recently received a pleasant reminder of the fact in the form of a check for $50. Mrs. Steele, after tying for first place in the preliminary contest at Mineral Wells, Texas, lost by a narrow margin in the finals, won by Miss Nida Boaz, Public Service Co. of Oklahoma, Tulsa, Okla.

S. L. BUTLER has become manager and proprietor of the Weidenthal-Gosliner Electric Works, 353 Tenth St., San Francisco, taking over the interests of J. Forster, former manager, who has returned to his business interests in Denver. Mr. Butler, although not previously connected with the electrical industry, has been active in business affairs in San Francisco all of his life. He has been connected with the Union Lumber Company, the Bode Gravel Company, the Spring Valley Lumber Yard, and the Mission Lumber Yard, of that city.

ADDISON B. DAY, president and general manager, Los Angeles Gas and Electric Corp., and newly elected president of the Pacific Coast Electrical Assn., has been selected to head the Community Chest campaign in Los Angeles for the coming year.

EDWARD H. MUNRO has been appointed Western sales promotion manager of the merchandising department of the Canadian Westinghouse Company. Mr. Munro's headquarters will be in Vancouver.

Obituary

Former Westinghouse Agent Dies in South

WALTER Hunter Whiteside, 70 years of age, Pacific Coast representative of the Westinghouse Electric & Manufacturing Co. until his retirement from active business six years ago, died July 17 at his home in Pasadena, Calif. His death was sudden and was caused by a heart attack.

Mr. Whiteside became Pacific Coast representative of the Westinghouse company in 1916, with offices in Los Angeles, Calif., and directed the business of the company on the Coast for ten years thereafter. During his residence in Los Angeles he was active in civic affairs and the work of the American Institute of Electrical Engineers and American Society of Mechanical Engineers.

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LEWIS J. WELLS, manager of the theatrical installation division of the Diamond Electrical Mfg. Co., Los Angeles, was killed in an airplane accident in that city July 16.

Contractor Dealer Inspector

Organize Branch in Coast Counties Area

Contractor-dealers in the Watsonville, Santa Cruz and Salinas area of California met at Watsonville in July and formed an organization which is to become a branch of the Northern Chapter, California Electragists. Arthur Farwell, Just-Rite Electric Co., Watsonville, was named president of the organization and Mrs. Stanovitch, proprietor, Central Electric Co., Watsonville, secretary. It was decided to hold meetings the second Monday of each month, inviting Salinas and Monterey contractors also to join the branch and form separate groups within the main organization. The present organization embraces the territory including Hollister, Gilroy, Santa Cruz, Watsonville and Morgan Hill. It is the plan of the organization to have group meetings in each of the towns at intervals to suit the local contractor-dealers and to have district meetings for the entire region once a month.

Edward Martin, president of the Northern Chapter, attended the organization meeting as representative of the chapter, and Frank Kiefer attended as representative of the Pacific Coast Electrical Bureau.

The organization resulted from a previous conference held after a meeting called by the Bureau for clarification of the merchandising policies of the Coast Counties Gas & Electric Co., serving that area. Following this first meeting a barbecue and general get-together was held at the Coast Counties Gas & Electric Co.'s Big Creek cabin earlier in the month. At that affair 65 were in attendance, including K. I. Dazey, managing director of the Bureau, J. B. Wilson, vice-president and general manager of the utility company, Pierre Vinet, commercial manager, and all department heads.

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THE DENVER ELECTRICAL CONTRACTORS ASSN. recently elected J. R. Collier president for the new year with William A. Guscott vice-president, and L. A. Vosmer treasurer. E. E. Stettler was appointed secretary pro tem. Two new members of the board of directors were elected, B. Swank and E. C. Headrick. This organization is making good headway with a quantity survey bureau, which is in charge of Lee H. Mattoon and M. H. Paulsen.

AIRPORT ELECTRIC COMPANY, of San Diego, not long ago completed the installation of nine 1,000-watt G.E. spread-lens floodlighting units mounted on poles for a golf-driving course at the Naval training station at San Diego.

Prominent

J. O. CASE, manager of the Quality Electric Co. Ltd., Los Angeles motor specialist, is an active participant in industrial electrification and motor section activities in southern California.

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Employees Buy Old Established Business

Purchase of the Morrison Electric Company, well known electrical contracting shop of Portland, by H. H. Parrott and H. C. Ploense has been announced. Mr. Parrott has been an employee of the company for 24 years of its 25 years of existence and has managed the business for the former owners for the past nine years. Mr. Ploense has been superintendent for the company for nine years.

The new owners plan to operate the business under its old name and in its present location at 13th and Washington Sts. and without making any changes in policy. The company, which is a member of the Association of Electragists-International, does a general electrical contracting business, sells electrical appliances at retail and is agent for a number of manufacturers of electrical products.

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THE TINDOLPH CO., Fifth Ave., Seattle, operated by E. F. Tindolph, representative for the Yale & Towne Mfg. Co., makers of electric hoists, electric trucks, etc., has taken over the Seattle agency for the Standard Conveyor Co. of North St. Paul, Minn. The latter company, which heretofore has had a direct factory representative here, manufactures gravity, spiral and power conveyors and pneumatic tube systems.

THE J. A. WERNER HARDWARE CO., LTD., Edmonton, Alberta, has opened a new branch, known as the Specialty Branch of the firm, on Jasper Avenue in that city. It is devoted exclusively to the sales and servicing of electrical household appliances.

Two Books Answer Code Questions

Appearing almost simultaneously but approaching the subject from two different angles are publications of questions and answers on the electrical safety orders of the California Industrial Accident Commission. The first is by Frank A. Short, electrical engineer of the commission, Los Angeles, and was written on the basis of answers to questions commonly asked him in his experience as inspector for the Commission.

In Mr. Short's introduction he states that the questions answered are those on the orders most frequently violated. Mr. Short's publication is temporarily issued in mimeographed form and contains 100 questions and their answers. The answers can be considered the Commission's official interpretation of the rules in the electrical safety orders.

The second publication is put out in pamphlet form by J. P. Murphy, electrical instructor of the Polytechnic Evening High School, San Francisco, and published by himself. This book contains 414 questions and answers, in addition to which are 130 questions and answers on the local rules and ordinances of the City and County of San Francisco. The introduction states that the book aims to interpret many of the rules to the satisfaction of the practical wireman.

Mr. Murphy's work is the result of teaching a class in the "Underwriters' Rules to Practical Men" at the Evening High School, where his best results were obtained by putting questions to the class and receiving their answers. The book is classified as to various types of wiring materials and problems and carries a comprehensive index. It is sold for $1 by the author.

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HARRY B. DOBSON, city electrical inspector, Santa Barbara, Calif., recently completed the installation of a new fire alarm system in Santa Barbara. The particular feature of the installation is the automatic alarm station itself. To make possible future additional panels, a gutter was provided around the entire room. Under the floor and connecting the gutter from opposite sides at 2-ft. intervals, three-duct tile was placed. Thus new equipment can be installed and the feeder run under the floor without disturbing the finish of the floor. The building also contains a separate battery room, work room, and motor-generator set room.

THE MARTIN HARDWARE CO., of Olympia, Wash., recently was awarded the contract for lighting the Capitol grounds for the state capital, Olympia, Wash.

EDWARD MARTIN, Sterling Electric Co., San Francisco, who has long specialized in radio sending station installations, has been installing the new broadcasting station of KFWI, San Francisco.

Manufacturer Distributor

Westinghouse to Push Refrigerator on Coast

To extend distribution of the new Westinghouse electric refrigerator in the eleven Western states, Carl D. Taylor, refrigeration sales manager of the Westinghouse Electric & Mfg. Co., Mansfield, Ohio, is on an extended visit of the Pacific Coast. It is planned, according to Mr. Taylor, to begin Western distribution of this refrigerator in October. Mr. Taylor has been in conference with C. A. Meier, merchandise regional sales manager for the Pacific Coast district, San Francisco, and Ivan L. DeJongh, recently appointed Pacific Coast refrigeration manager, for the evolution of distribution plans which will fit in with the particular condition he found in the West.

In general, distribution will be made through private distribution organizations, each having its own dealers. Wherever possible distribution will be made through central stations with a cooperative arrangement whereby dealers can tie in.

Up to this time, according to Mr. Taylor, it has been impossible for the factory to keep up production for this increasing demand for refrigerators. Although manufacturing since 1929, Westinghouse has not sold refrigerators in the Western states until recently in the Northwest. With the falling off in summer demand enough refrigerator stock can be released to start the Western organization. In order to take care of the anticipated demand for next year, the company is already making plans for increase of production by 250 per cent of the present rate.

With the company's launching of the Western distributing organization elaborate national magazine advertising will make its appearance and a local newspaper advertising campaign will start in the eleven Western states. At the present time only domestic units from 3 to 18 cu. ft. in capacity and water coolers will be distributed in the Western territory. By 1932 commercial units will be added to the line, according to Mr. Taylor.

Mr. Taylor will be accompanied by Mr. deJongh in covering all of the major cities on the Pacific Coast during his six weeks' visit. The service and distribution organization for the refrigerators has already been effected by Mr. deJongh.

Carl D. Taylor of Mansfield, Ohio, explains the workings of the new refrigerator to Messrs. De Jongh and Meier

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San Francisco to Control Graybar Salt Lake Branch

Announcement has been made by the Graybar Electric Co. that on July 1 its branch in Salt Lake City, which formerly was under the management of the Denver branch, was placed under the management of the San Francisco office, headquarters of E. J. Wallis, Pacific District manager.

J. M. Perlewitz continues as sales manager at Salt Lake City, and the personnel of that office remains the same.

T. A. Fawell Joins Marwood L. A. Offices

Thomas A. Fawell has been appointed manager of the Los Angeles office of The Marwood Co., 310 East 4th St., according to an announcement made by Martin Woodard, president of The Marwood Co. Mr. Fawell, who was formerly in the San Francisco office, succeeds Ralph B. Clapp in the Los Angeles office. Mr. Clapp recently resigned from the organization.

Among manufacturers represented on the Pacific Coast by The Marwood Co. are: Continental Diamond Fibre Co., makers of fibre, bakelite, and mica; U.S. Graphite Co., carbon brushes; Anchor Webbing Co., tapes, sleeving etc.; and Martindale Electric Co., maintenance equipment. Complete stocks of supplies and equipment, as well as electrical repair and maintenance shops are maintained at The Marwood Co.'s stores in Los Angeles, San Francisco, Seattle, Spokane, Portland and Vancouver.

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WESTINGHOUSE OPENS PORTLAND SERVICE SHOP—A new service shop has been opened by Westinghouse Electric & Mfg. Co. in Portland at 464 Interstate Ave. It will be known as the Portland Service District Branch and will be managed by J. A. O'Connor, for some years connected with the Westinghouse assembly plant at Emeryville, Calif. The shop will take care of all service of Westinghouse equipment in the Portland area.

H. J. GUTE & Co., San Francisco, has been appointed Pacific Coast representative of the Electrical Division of the National Enameling & Stamping Co., Milwaukee, Wis.; E. Z. Hedge Trimmer Co., 168 Madison Ave., New York; and Eagle Mfg. Co., Springfield, Ohio, maker of an electrical vegetable slicer.

A CORRECTION—An announcement in ELECTRICAL WEST last month to the effect that Garnett Young & Co., San Francisco, would handle distribution of Appleton Electric Co.'s products on the Pacific Coast failed to state that Appleton factory branches in this territory would function as before. These are maintained at Seattle, San Francisco and Los Angeles.

FARNHAM & CUNNINGHAM, M-29 Edison Bldg., Los Angeles, has been appointed by Kelman Electric & Mfg. Co., of that city, as its sales representative for oil circuit breakers in Arizona and in San Diego, Calif.

TWO NEW LINES FOR DENVER DISTRIBUTOR—The Central Electric Supply Co., Denver, has been appointed distributor in that territory of the "Faultless" electric washer manufactured by the Vulcan Mfg. Co., Kansas City, Mo. The Central company has also become a distributor recently of the "Mark-Time" switches made by M. H. Rhodes, Inc., New Haven, Conn.

Electric Products Corp. Opens Western Branch

National Electric Products Corp., Pittsburgh, Pa., has opened an office and warehouse at 400 Potrero Ave., San Francisco. Stocks and active operations for the company in the states of Washington, Oregon, California, Arizona and Nevada will be taken over by the San Francisco branch.

H. J. Newton, formerly division sales manager for the company in Pittsburgh, has been appointed Pacific Coast manager. The San Francisco sales staff will consist of C. E. Bowermaster, formerly a member of the sales department of the company in Pittsburgh; Arthur Kempston, formerly chief of the electrical department of San Francisco and more recently manager of the Eastern territory for Majestic Electric Appliance Co., who will be sales engineer; W. D. Ross, formerly with the Hoffman Specialty Co. of California; and William Tardiff, formerly representative of Walker Bros.

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NEON PRODUCTS OF WESTERN CANADA, LTD., Vancouver, B. C., has incorporated in the province of Alberta as an extra-provincial company with provincial headquarters at Calgary. Authorized capital of the Alberta firm is set at $72,272.

SELLING G.E. APPLIANCES IN HOOVER DAM VICINITY—The store of H. E. Saviers & Son, Las Vegas, Nev., has been made Clark County headquarters for General Electric household equipment. H. D. McCoy is manager.

C. S. BARDEEN, secretary, Canadian Fairbanks-Morse Co., Ltd., recently returned to his organization's head office in Montreal after a visit to the Vancouver and Victoria offices of the company.

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Chance Co. Conducting Golf Tournament

A national golf tournament for men and women of the electrical industry is being conducted by the Chance Co., Centralia, Mo. Contestants are divided into two classifications, distributors and consumers. The tournament, which was started on April 20, will continue until Sept. 20.

Lessons written by Tommy Armour, golf professional, are sent each month to the players, and with them are included "business reply cards" for the return of scores, properly attested.

First prize winners in each division will be given a six-club matched set of Kroydon irons; second prize, the winner's own choice of any make driver and brassie; third prize, two dozen Silver King golf balls in each division. First place winners will be invited by Chance Co. to play a final match on some selected course, probably in some Eastern city, the winner of which will be presented with a handsome trophy standing 29½ in. high. All expenses will be paid by the company.

"Bichronous" Disciple

PAUL H. OWSLEY

manager of Hammond Clock Co.'s direct factory branches just opened in Los Angeles and San Francisco. Mr. Owsley has been assistant sales manager in Chicago for the past year. Dealer contact men will shortly be named in both California cities

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Patent Suits Brought Against Sign Companies

Five sign companies have been named defendants in preliminary writs of injunction signed by Federal Judge George M. Borquin, to prohibit them from infringing upon patents issued to the Claude Neon Electrical Products Corp., Inc., and the Electrical Products Corp. of Washington. The companies are Neon Specialty Mfg. Co., the National Neon Co., the Acme Sign Co., Multichrome Tubelight, Inc., and the Campbell Sign Co.

The patent infringement suits are pending in the federal court. The case was originally heard in Seattle in the federal court, the lower court sustaining the companies holding the license rights. An appeal was made and the circuit court in a recent decision sustained the lower court.

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DIAMOND ELECTRICAL MFG. CO., Seattle, has received contract for approximately $15,000 worth of Square D dead-front distribution power panels to be installed in the Ford Motor Co.'s $3,200,000 assembly plant under construction in Seattle.

WESTON ELECTRICAL INSTRUMENT CORP., Newark, N. J., announces that it has acquired the business and assets, subject to the liabilities, of Jewell Electrical Instrument Co., Chicago. The Jewell activities will be conducted by a newly organized subsidiary company to be known as Jewell Electrical Instrument Co., which will continue manufacture at the Chicago plant under the old management. Orval Simpson has become chairman of the board of directors and Ray R. Simpson is president of the new company.

Line Material Maker Forms Appliance Division

The National Telephone Supply Company, Cleveland, Ohio, manufacturer of electrical specialties for line construction and maintenance work, has announced the formation of an electrical appliance division.

This division will manufacture and sell a line of home and table electrical appliances at moderate prices. The first two items announced for the line are an automatic egg cooker and an automatic baby bottle warmer, to be known respectively as the "Eggster" and the "Milkster."

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J. M. SPAIN, formerly manager of the Southern California branch of the California Victor Distributing Co., and for a short time affiliated with the Radio & Music Trades Assn. of Southern California, has been appointed sales manager of Pacific Wholesale, Ltd., Los Angeles. Pacific Wholesale handles Black & Decker washing machines, Holbrook-Merrill & Stetson refrigerators, and Sparks-Withington radio receiving sets.

THE EASY HOUSEKEEPING SHOP, INC., distributors of Easy washers and ironers in the southern California territory, has recently changed its headquarters from 928 West Seventh St. to the Edison Bldg. in Los Angeles, according to Frank E. Ford, president.

DIESEL-ELECTRIC propulsion will be used on a new 121-ft. lighthouse tender, the *Columbine*, now being built by the Moore Dry Dock Company at its Oakland works. Electrical equipment for the new boat will be furnished by the General Electric Co.

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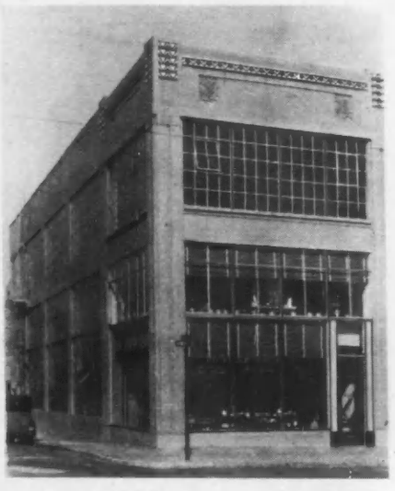
Unit of "Electrical City"



New home of Royal Rochester, Inc., California branch of the Robeson-Rochester Corp., of Rochester, N. Y., at 267 Ninth St., San Francisco. The building is the latest addition to San Francisco's "Electrical City"

New Products

Vacuum-action Dishwasher

No moving parts are in the new Cinderella electric dishwasher, being marketed by the Black & Decker Mfg. Co., Towson, Md. A vacuum action, caused by an enclosed motor and pump mechanism, forces the water over and around the dishes and out into the sink. Water enters through an extension connecting directly on the faucet, so that the housewife has nothing to do but put in and take out the dishes. Automatic rinsing obviates drying by towel. Mounted on casters, it is low enough to roll under any sink completely out of the way. Finished in same colors as the Cinderella washer. List price, $127.50.—ELECTRICAL WEST, Aug. 1, 1931.

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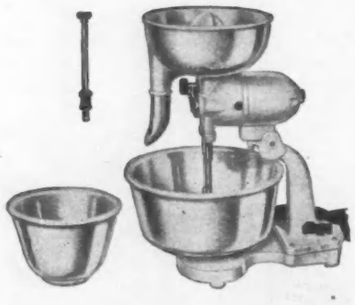

Improved Mixer-Juice Extractor

A combination mixer-juice extractor, the Mixmaster, is being distributed by Sandoval Sales Co., 537 Market St., San Francisco. This appliance contains a salad oil dripper which releases oil drop by drop into any mixture at a predetermined rate. The juice extractor can be used while the mixer is working, and at any speed wished. Easily cleaned, the mixers come off separately. The device is sturdy, portable, yet occupies little space. Mixing and juicer bowls are of heavy green glass. Catalog No. M4B, with two bowls and juicer, $24.75.—ELECTRICAL WEST, Aug. 1, 1931.

Okosheath Cable

The Okonite Co., of Passaic, N. J., announces Okosheath cable for underground work in ducts or for burial directly in the ground. The construction of this cable is extremely simple, the conductor being covered with a single, thick sheath of tough rubber compound which provides the required insulation, excludes moisture, cushions the conductor from impact, resists abrasion and is inherently impervious to the action of chemicals. Literally, this cable is as simple as a pencil and a lineman can splice it with his accustomed tools. The low initial cost of this underground cable, its light weight, its cleanliness, the ease of splicing it and its great flexibility offer opportunities for the economical expansion of underground distribution areas.

Okosheath is supplied single-conductor only for 600-volt service, in sizes from No. 14A.W.G. to 2,000,000 circ.mils.—ELECTRICAL WEST, Aug. 1, 1931.

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Hewitt Toaster

Slice-a-minute toasting is offered by the Hewitt Electric & Mfg. Co., Arlington, Mass., in its new automatic bread and sandwich toaster. With this toaster, no preheating is required. Fully automatic, the current clicks off when the bread or sandwich is toasted to the brownness desired, governed by a control on the front. Light weight top avoids squeezing out sandwich fillings. Finished in chromium with attractive jewel box shape. In 600-watt size, list price $13.50.—ELECTRICAL WEST, Aug. 1, 1931.

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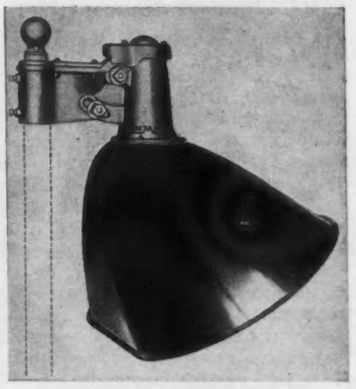
New Low-priced Washer

No. 77 Spinner, a new washer in the lower-priced field, has been added to the line of Altorfer Bros. Co., Peoria, Ill. This ABC addition has a round tub with nonchipping porcelain facing. Surfaces are curved for easier cleaning. All fittings and parts exposed to water are rustproof. The revolving turret locks in any position and returns suds to the washer and rinse-water to the tubs in one operation, without a pump. Washer and spinner basket driven simultaneously by ¼-hp. motor. Operating mechanism is sealed in oil. The unit also rinses, blues, starches, and dries. It spins a tub dry for the line in a few seconds. Washing and drying capacity is 55 lb. dry weight per hour. Price, $129.50.—ELECTRICAL WEST, Aug. 1, 1931.



Play Area Floodlight

Benjamin Electric Mfg. Co., Des Plaines, Ill., announces a play area floodlight, No. 5,752, providing uniform and strong illumination on the ground and to the front and sides of the unit. It is an open-type unit, wide angle diffusing floodlight with reflecting surface of diffusing porcelain enamel in combination with an inner reflector of oxidized aluminum. The mounting bracket provides a wide range of adjustment, both horizontally and vertically.—ELECTRICAL WEST, Aug. 1, 1931.

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Rheostat and Resistance Units

Two new products of the Ohmite Mfg. Co., 636 North Albany Ave., Chicago, are a rheostat for all types of control circuits and a series of semi-variable resistance units.

The rheostat incorporates the use of a circular porcelain core on which the resistance wire is wound, the core forming a solid, non-shrinking backing for the wire. This wound core is mounted on a porcelain base, and the entire unit, with the exception of the surface where the wiper arm makes contact, is covered with vitreous enamel which cements the whole unit together and serves both to protect the wire and to carry off the heat generated in the wire. The rheostats in this line have a maximum rating of 50 watts, and are carried in stock in a wide range of resistances.

New semi-variable resistance units, having the enamel bared on one side along their length so that contact may be made with the resistance wire by an adjustable clip, have been developed to bridge the gap between fixed resistance units and the new rheostats. Two types of adjustable clips can be supplied, one that is fitted with bolt and nut and is tightened with a screwdriver, and the other fitted with a Bakelite knob so that it may be tightened with the fingers. These units are made in the 30-watt, 55-watt, and 75-watt sizes in a large range of resistance values.—ELECTRICAL WEST, Aug. 1, 1931.

Improved Oil Test Set

Two new features are to be found in the AmerTran type TS-6B portable test set for testing transformer oil, manufactured by the American Transformer Co., of Newark, N. J. The first is a safety device that makes it impossible to come in contact with high-voltage parts while the set is in operation; the second permits more precise results by providing a means for increasing the test voltage from zero to maximum at a rate of approximately 3 kv. per second. —ELECTRICAL WEST, Aug. 1, 1931.

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Rite-Lo-Speed Motor

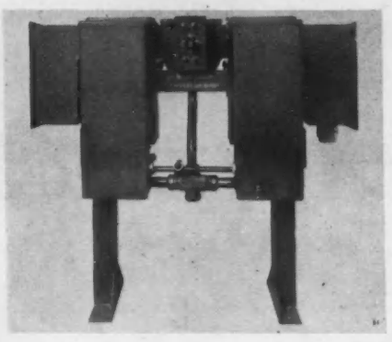
A late development in power transmission and direct motor drive equipment is being introduced by the J. D. Christian-Engineers, 512 Brannan St., San Francisco. It is known as the Rite-Lo-Speed motor. The motor embodies a standard footless stator and rotor and heat treated alloy steel helical gears. These are ball bearing and are mounted and arranged in a compact manner, so that the entire assembly is scarcely larger than the motor itself. The motor has been developed in cooperation with the manufacturers of U. S. asbestos-protected motors, Los Angeles.

The gear end of the assembly presents a unique design which is not in any way a planetary system, there being only two gears and two pinions. It is so arranged that a heavy overhung pull can be taken on the final shaft without the use of an outboard bearing, according to Mr. Christian. The oiling case is sealed from the motor by a unique arrangement. Careful design assures a factor of rigidity and sturdiness sufficient for all loads, and the entire assembly is protected by a dirtproof and waterproof housing. The motor is being manufactured in four series. Series A is standard, comprised of the motor and housing with a single power take-off. Series B is a single motor unit with a gear housing at each end having two power take-offs at the same speed. Series C is the same as Series B with the exception that it has two power take-offs at different speeds. Series D is a single motor unit with gear housing at one end with power take-off at reduced speed, and with a high speed motor shaft extended through the rear end bell. The motor is at present made in sizes from 1 to 30 hp., and a junior model is made in sizes from ¼ to 1 hp.—ELECTRICAL WEST, Aug. 1, 1931.

Metal-Clad Switchgear

A recent development of the Delta-Star Electric Co., Chicago, is this metal-clad switching unit for power distribution, control of station auxiliaries, across-the-line motors or similar service where flexibility of operation, safety and minimum space requirements are desired.

This unit consists of two 7.5-kv., 600-amp. electrically operated 3-pole oil circuit breakers mounted on a steel frame and complete with current transformers and cable compartments. The breakers are mechanically and electrically interlocked so that both cannot be in circuit at the same time. Conveniently mounted on the front is a control panel with switches and indicating lamps. A removable handle is also provided for manual operation. The cable entrances are equipped with terminators to safeguard the cable ends and provide a ready means for sealing the cables against moisture. This gear is completely enclosed in steel and factory assembled; the only field work required is bolting to the floor and connecting the cables.—ELECTRICAL WEST, Aug. 1, 1931.



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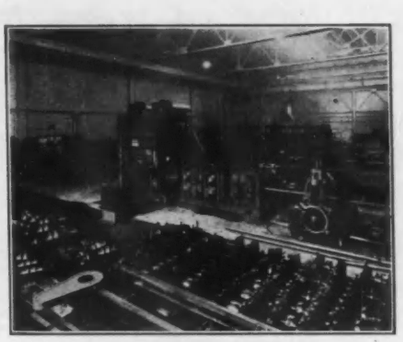
Electric Welding Unit

The completion of an electric welding unit which greatly increases the range of steel tubing produced by the Johnson process is announced by Steel and Tubes, Inc., Cleveland, Ohio. The new unit electrically welds tubing up to ¼ in. in thickness and up to 5 in. in diameter. The machine is so constructed that large coils of flat steel stock are fed into the forming rolls to be formed cold into a tube. This passes directly under the electrodes where fusion takes place, without the addition of foreign metal, at a speed of approximately 80 ft. of tubing per minute. The welding burr is eliminated and the weld is almost imperceptible.—ELECTRICAL WEST, Aug. 1, 1931.



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S-2 Sunlight Lamp

A new ultra-violet lamp, the S-2, has been added by the General Electric Co. to its type S Mazda sunlight lamps. In this lamp the arc length has been materially increased, and a metal cap has been placed over the lower portion of the bulb, with the result that the lamp emits about one-half the ultra-violet radiation of the present S-1 type, but consumes only 40 per cent of the wattage.—ELECTRICAL WEST, Aug. 1, 1931.

Trade Literature

¶ VERTICAL NETWORK—Burndy Engineering Co. bulletin on the bus system and electric service in the Southern California Edison Co. Ltd. building in Los Angeles.

¶ SWITCHES AND PANELS—Wadsworth safety electrical switches and distribution panels are fully described in catalog No. 100-A, recently published by the Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

¶ PHANATRON TUBES—Gas and vapor content vacuum tubes are treated at length in General Electric's latest booklet. Charts, drawings and test data are included with text which answers such questions as, How does the Thyratron operate? What is maximum peak inverse voltage? What are the characteristics of various vacuum tubes?

¶ CLOTHES WASHING—A booklet prepared by The Black & Decker Mfg. Co., Towson, Md., advances money-saving suggestions on the best way to wash various fabrics. Especially suited for home economics work.

¶ HIGH VOLTAGE LINES INSULATION—A paper presented before the International High Tension Congress, at Paris, has been printed in booklet form by the Ohio Brass Co., Mansfield, Ohio. Illustrated with pictures, drawings, and charts, the story discusses conductor heights, high ground wires, span lengths, station insulation, radio interference, effect of polarity and height upon direct lighting strokes and increasing flashover by tower clearances, among other things.

¶ THROUGH PUMPLAND—A bound booklet of interesting installations, profusely illustrated, has been published by Layne & Bowler Corp., Los Angeles. Stories of outstanding pump jobs, with pictures, comprise the main portion of the booklet, but many useful tables and reference data are included.

¶ BALL AND ROLLER BEARINGS—This is the ninth edition of the Aetna Ball Bearing Mfg. Co., Chicago, catalog, and contains applications of thrust and roller bearings with typical mountings for both types. Formulas for calculating horsepower, torque, and end thrusts are presented, as the publication is designed as a handbook for designers and draftsmen.

¶ POWER FILTERS—Square D Co., Detroit, has published this folder on its new power filter unit to convert alternating current into direct current for use on telephone, public address, clock and signal systems, etc.

¶ MOTORS—Reliance Electric & Engineering Co., Cleveland, Ohio, is distributing a booklet on heavy duty motors for direct current applications. With the story and tables, illustrations of typical applications and installations are used.

¶ MAGNETIC CLUTCHES—"Keeping Pace with Machine Design" is a booklet just issued by Cutler-Hammer, Inc., Milwaukee, Wis., on the construction, operation and application of magnetic clutches. Schematic diagrams demonstrate the action and illustrations indicate the variety of applications.

¶ MERCHANDISING MANUAL—Conlon Corp., Chicago, in this manual, cites questions usually asked by prospects, most convincing answers, approved methods of selling, salient features to stress in selling any appliance and general information of value to any salesman or dealer. In loose-leaf form, revisions and addenda may be included in the future.

¶ CHROMALOX UNITS—The story of these range replacement elements is well told in an attractive booklet published by Edwin L. Weigand Co., Pittsburgh, Pa. Manufacture, use, adaptability, exclusive features and price lists with data on all types and makes of ranges are included.

¶ BEARINGS—Problems of bearing seizure in motors and the story of babbitt bearings is told in a bulletin issued by Wagner Electric Corp., St. Louis.

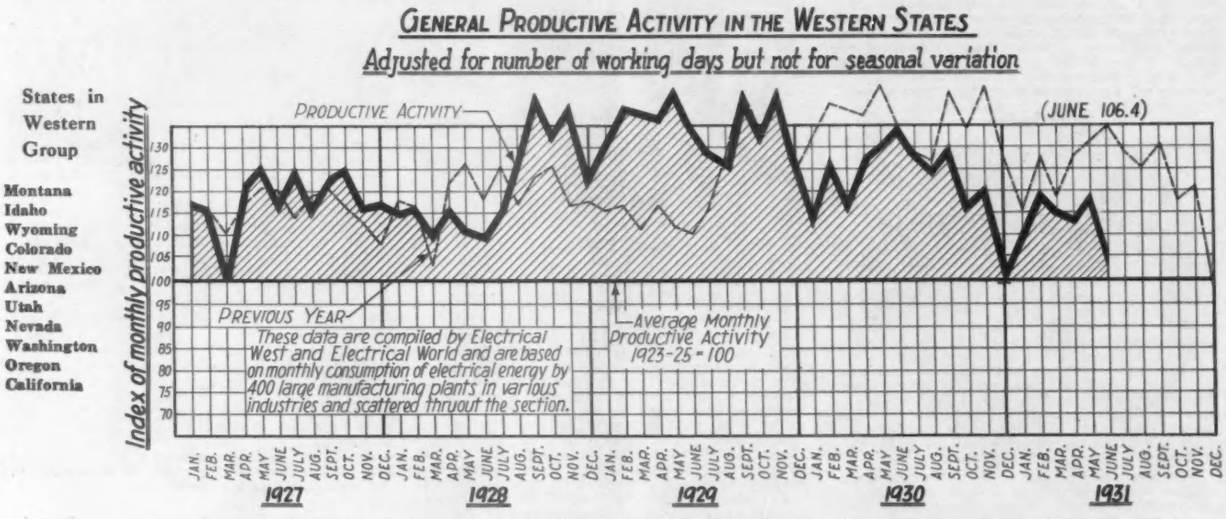
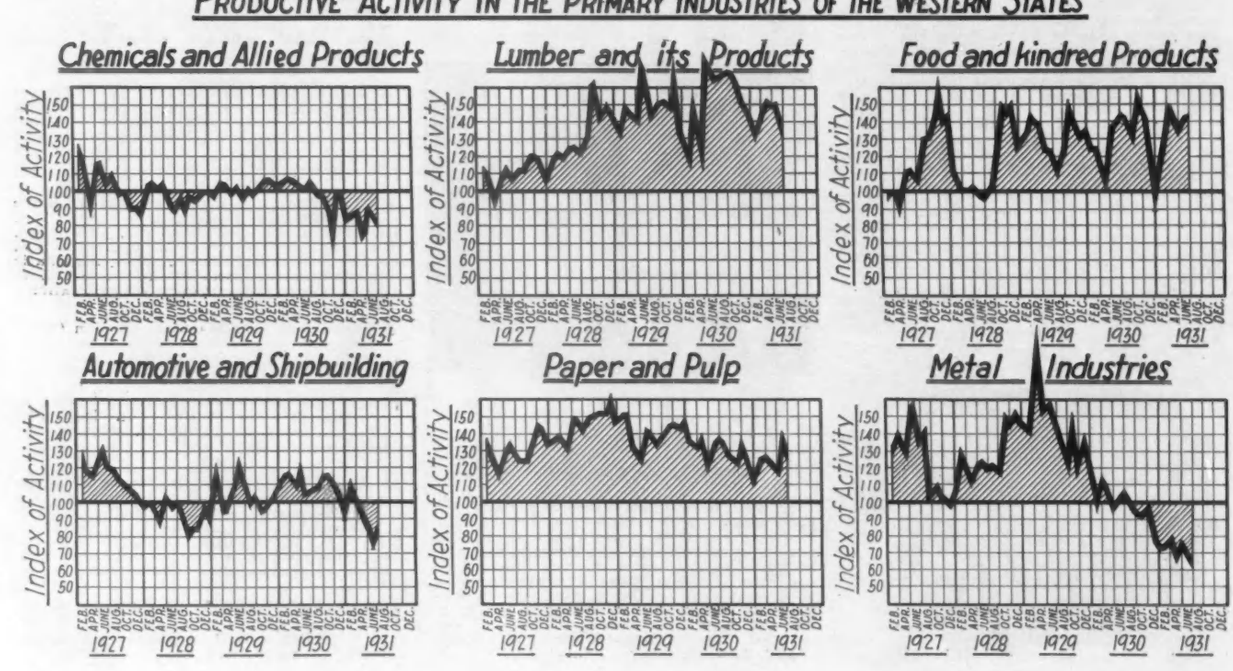
Barometer

AS IN other sections of the country, manufacturing activity in the West decreased from May to June, the change amounting to about 10 per cent. The measure of industrial activity here used is the electrical energy consumed in individual manufacturing plants, which in general varies in close agreement with production. The June index remains, however, 6.5 per cent above the low point of last winter, though lower than in any other recent month. The contrast with 1930 is accentuated by the fact that last year activity increased from May to June. Consequently the deficiency, which in May was 8.5 per cent, rose in June to 21 per cent.

The decrease was general. The only conspicuous exception was in the foodstuff industry, which not only rose slightly but came within 1 per cent of equaling last year's figure, the highest June of the present series of records. In this respect the West is not unique; returns from the industry throughout the United States point to a summer peak second only to that of 1930.

The forest products industry shows a recession of 10 per cent; declines were reported also from other regions. Chemicals continue, with fluctuations, about 30 per cent below 1930 levels. The metals group again receded, reaching the lowest point in years, more than 40 per cent under 1930 operations, which were already low. Here again conditions in the West are only paralleling those elsewhere.

Indexes of Industrial Activity in the Western States

(All figures adjusted for number of working days.)

	June 1931	May 1931	April 1931	June 1930	Average First Six Months 1931	Average First Six Months 1930
All Industry	106.4	119.1	114.0	135.0	114.5	125.5
Chemical and allied products	78.0	90.2	75.2	109.7	80.6	107.1
Food and kindred products	145.4	144.8	138.1	147.5	142.0	131.3
Forest products	139.0	154.1	150.1	164.5	146.4	153.1
Metals group	60.8	69.7	71.4	108.5	68.7	103.5
Paper and pulp	132.4	143.3	120.6	138.5	129.3	133.6
Rubber and its products	151.9	166.0	155.6	168.0	159.9	169.2
Shipbuilding	80.5	74.5	82.0	109.3	90.9	115.8
Stone, clay and glass	89.5	89.2	94.6	113.8	93.2	100.2